

ENVIRONMENTAL ASSESSMENT FOR
High Energy Mobile X-Ray Inspection Systems
Port of Los Angeles, Port of Long Beach, and Carson Container
Examination Station,
Los Angeles County, California



U.S. Customs and Border Protection

DEPARTMENT OF HOMELAND SECURITY
U.S. CUSTOMS AND BORDER PROTECTION
INTERDICTION TECHNOLOGY BRANCH

DRAFT REPORT

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**ENVIRONMENTAL ASSESSMENT FOR
HIGH ENERGY MOBILE X-RAY INSPECTION SYSTEMS
PORT OF LONG BEACH, PORT OF LOS ANGELES, AND CARSON
CONTAINER EXAMINATION STATION,
LOS ANGELES COUNTY, CALIFORNIA**

April 2007

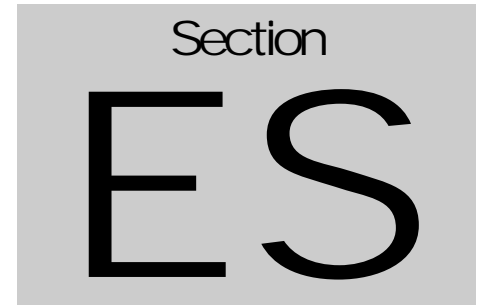
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PORT OF LOS ANGELES, PORT OF LONG BEACH, AND CARSON
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Executive Summary

Introduction

This Environmental Assessment (EA) addresses the potential environmental effects, beneficial and adverse, of the fielding and operation of High-Energy Mobile X-Ray Inspection Systems by the U.S. Customs and Border Protection (CBP) at the Port of Los Angeles, Port of Long Beach and Carson Container Examination Station (CES), Los Angeles County, California. This EA satisfies the requirements specified in the National Environmental Policy Act of 1969 (NEPA) as amended, the Council on Environmental Quality regulations implementing NEPA (40 CFR 1500-1508), and Department of Homeland Security Procedures Relating to the Implementation of the National Environmental Policy Act (71 FR 16790-16820, April 4, 2006). NEPA requires CBP and other federal agencies to fully understand, and take into consideration during decision making, the environmental consequences of proposed federal actions.

Part of a comprehensive mix of technologies designed to complement one another and present a layered defense to smuggling attempts, High-Energy Mobile X-ray Inspection Systems allow CBP Officers to inspect for contraband without having to physically enter into or unload vehicles or containers. Congressionally funded and directed, High-Energy Mobile X-ray Inspection Systems fulfill Non-Intrusive Inspection (NII) technology requirements found in (1) The Office of National Drug Control Policy (ONDCP) *National Drug Control Strategy*; (2) The Office of National Drug Control Policy (ONDCP) *Ten Year Counterdrug Technology Plan and Development Roadmap*; (3) The CBP *Container Security Initiative*; (4) National Security Presidential Directive – 17/Homeland Security Presidential Directive – 4 *National Strategy to Combat Weapons of Mass Destruction*; (5) National Security Presidential Directive – 43/Homeland Security Presidential Directive – 14 *Domestic Nuclear Detection*; (6) *U.S. Customs and Border Protection 2005-2010 Strategic Plan* and (7) *The SAFE Ports Act of 2006*.

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Purpose and Need

The purpose of the Proposed Action is the fielding and operation of five High-Energy Mobile X-Ray Inspection Systems at Port of Los Angeles and Port of Long Beach, Los Angeles County, California, for the purpose of conducting non intrusive inspections (NIIs) of high-density cargo containers for contraband such as illicit drugs, currency, guns, and weapons of mass destruction. For the purposes of this environmental analysis, high-density cargoes and containers are defined as having a density greater than 6 inches of steel.

The need of the Proposed Action is to assist in fulfilling the requirement for the 100% scanning of containers entering the United States directed in the SAFE Ports Act of 2006 (H.R. 4954). Because of the sheer volume of sea container traffic and the opportunities it presents for terrorists, containerized shipping is uniquely vulnerable to terrorist attack. The Port of Los Angeles is the busiest container port in the United States and the eighth busiest container port in the world (Port of Los Angeles, 2005a) During the period of January-December 2004, the Port of Los Angeles moved 7,321,440.10 Twenty-foot Equivalent Units (TEUs) through the port; a 1.98% increase in, or 142,500 more, TEUs than 2003 (Port of Los Angeles, 2005b). The Port of Long Beach is the second busiest container port in the United States and the twelfth busiest container port in the world (Port of Long Beach, 2003). During the period of January-December 2004, the Port of Long Beach moved 5,779,852 TEUs through the port; a 24% increase in, or 1,121,728 more, TEUs than 2003 (Port of Long Beach and U.S. Department of Commerce, 2005). In order to effectively inspect high-density cargoes and containers, NII candidates must be able to provide penetration of greater than 6 inches of steel.

The systems will be stored at the Carson Container Examination Station (CES) and operated at the Ports as required.

Proposed Action and Alternatives Considered

Under NEPA, the proponent for an action is responsible for considering a reasonable range of alternatives that could accomplish the agency's objectives. If alternatives were eliminated from detailed study, reasons for their elimination must be briefly discussed.

Two alternatives were evaluated based upon their ability to provide the required operational capacities identified in the purpose and need statement. The two alternatives considered were:

1. Fielding and Operation of the High-Energy Mobile X-Ray Inspection System
2. The No-Action Alternative

Fielding and operation of the High-Energy Mobile X-Ray Inspection System was chosen as the preferred alternative and is presented as the Proposed Action.

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Proposed Action

The Proposed Action is to field and operate four Hiemann Cargo Vision (HCV-2) and one Mobile Eagle® High-Energy Mobile X-Ray Inspection Systems at the Port of Los Angeles and Port of Long Beach, Los Angeles County, California for the purpose of conducting NIIs of high-density cargo containers. The High Energy Mobile X-Ray Inspection Systems will be stored at the Carson CES and moved to any area of the ports suitable for conducting inspections as required. There is no additional construction or infrastructure required for the operation or storage of the systems.

No Action Alternative

The No Action Alternative is the status quo, to visually, and by using gamma imaging inspection systems, inspect the cargo containers for the presence of persons or indications of the presence of contraband. If the CBP Officer detects or believes that persons or contraband may be present, the container is directed to an area designated for the manual offloading and inspection of cargo. Although the No Action Alternative does not meet the purpose and need, it serves as a basis of comparison to the Proposed Action and other alternatives.

Other Alternatives Considered

Two additional alternatives were found to be reasonable for providing CBP with the capability to inspect containers with high-density cargoes.

3. Mid-Energy X-Ray Inspections Systems ($0.25 < 2 \text{ MeV}$);
4. Gamma Imaging Inspection Systems ($\text{Cs}^{137}/\text{Co}^{60}$)

Each of the alternatives was evaluated on its ability to provide the required functional capability to support the CBP mission. Alternative (3), Mid-Energy X-Ray Inspection Systems, and Alternative (4), Gamma Imaging Inspection Systems, were determined to NOT be functionally viable in meeting the mission requirement for penetration of high-density cargo and therefore were not carried forward for detailed analyses.

Environmental Consequences of the Proposed Action and Alternatives

This EA documents that the Proposed Action will result in no significant environmental impacts, direct, indirect, cumulative or otherwise.

The Ports of Los Angeles and Long Beach are located in Los Angeles County, California on the north side of the San Pedro Bay. The Carson CES is also located in Los Angeles County to the north of the Ports of Los Angeles and Long Beach.

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Climate - The Proposed Action will not have an impact on the climate.

Geology and Soils – No construction or excavation is required for the Proposed Action. The Seismic hazards related to liquefaction and ground shaking would have minimal impact on the High Energy Mobile X-Ray Inspection Systems. No impacts to geology or soils are anticipated. Direct impacts to geology and soils would not occur from the implementation of the Proposed Action.

Hydrology and Water Quality - The Proposed Action will not affect hydrology, water resources or water quality.

Floodplain – There are 100 and 500 year floodplains located at the Ports of Los Angeles and Long Beach. The Carson CES is not located in a floodplain. The Proposed Action will not have an impact on these floodplains.

Wetlands – The Proposed Action will occur on previously paved surfaces at the Ports of Los Angeles and Long Beach or at an existing parking lot at the Carson CES. The Proposed Action will not be located in a wetland and will not impact any wetlands.

Coastal Zone – The Ports of Los Angeles and Port of Long Beach are located in the California Coastal Zone. The Carson CES is located outside of the California Coastal Zone. The Proposed Action is consistent with current actions at the Ports. No Coastal Zone resources will be adversely affected by the Proposed Action.

Vegetation and Wildlife – The Proposed Action will occur on previously paved surfaces and will be consistent with current actions at the Ports and CES. No vegetation or wildlife will be impacted by the Proposed Action.

Threatened and Endangered Species – The Proposed Action will not cause any disturbances to critical habitats or impact threatened or endangered species in the course of operation. An area on Pier 400 of the Port of Los Angeles has been established as critical nesting habitat for the California Least Tern (*Sterna antillarum browni*). The nesting area is located outside of the operational area of the Port. Neither the California Least Tern nor any other threatened or endangered species will be impacted by the Proposed Action.

Air Quality – The Ports of Los Angeles and Long Beach and the Carson CES are located in Los Angeles County, CA. Los Angeles County is located in the Los Angeles South Coast Air Basin, CA. This area is designated as an air quality non-attainment area for Ozone (8-hour), Carbon Monoxide, PM-10 and PM-2.5. The Proposed Action will not significantly affect air quality. Worst case scenario studies have shown emissions resulting from the Proposed Action to be substantially lower than the state and Federal requirements for this area. Conformity analysis conducted in accordance with 40 CFR 93, Subpart B, shows emissions for these criteria to be *de minimus*. No long-term air quality impacts would occur. Impacts to air quality were found to not be significant.

Noise – The Proposed Action will not exceed any of the pre-existing noise conditions nor limit requirements and is consistent with current actions at the Ports and CES. As a result, the Proposed Action will not have a significant noise impact.

Land Use and Zoning - The Proposed Action is consistent with current actions at the Ports and CES and will not impact land use or zoning.

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Aesthetics and Visual Resources - The Proposed Action would not obscure or result in abrupt changes to the complexity of the landscape and skyline when viewed from points readily accessible to the public. No long-term change to the character of the area would occur as a result of the Proposed Action.

Infrastructure / Utilities - The Ports of Los Angeles and Long Beach and Carson CES have pre-existing water and electrical services. The Proposed Action will not impact the infrastructure and utility services of the Ports and CES.

Traffic / Transportation - The Proposed Action will not impact the parking and accessibility to the Ports of Los Angeles and Port of Long Beach and the Carson CES and will not impact the flow of traffic in and out of the Ports or the CES.

Waste Management - Wastes associated with the Proposed Action are lubricants for the operation and maintenance of the HCV-2's and Mobile Eagle®. These lubricants accumulated in approved containers at or near the point of generation and recycled for use again by a licensed waste recycling company. 40 CFR 279 exempts used lubricants from consideration as a hazardous waste if it is managed through a used oil recycler and is not mixed with any other hazardous wastes. The operation and maintenance of the systems would not result in generation rates that would exceed 100 kilograms (220 pounds) of waste in any calendar month (Conditionally Exempt Generator).

Historical and Archeological (Cultural) Resources - The Proposed Action will be consistent with current actions at the Ports and CES. There will be no impact to historical or archaeological resources from the Proposed Action.

Socioeconomic - The Proposed Action will not alter the population distribution or growth rates or have any short or long-term effects on the socioeconomics of the region.

Environmental Justice - Implementation of the Proposed Action is not expected to have any negative or disproportionate effects on minority and low income populations or children.

Irreversible and Irretrievable Commitment of Resources - Irreversible and irretrievable commitment of resources associated with the Proposed Action will be materials, utilities, labor and time expended to the operation of the HCV-2's and Mobile Eagle®.

Radiological Health and Safety - Radiological impacts associated with the Proposed Action have the potential to impact the health and safety of operators, officers and the general public. As promulgated by the Nuclear Regulatory Commission (NRC) in 10 CFR Part 20, the maximum permissible level of radiation dose to the general public is 100 mrem (100,000 µrem) in a year. Due to the nature of their job, CBP Officers and port employees who work around the systems have the potential to be "occupationally exposed" to radiation. However, CBP has elected to use the general public standard, 100 mrem in a year, as the maximum permissible level of radiation dose for CBP officers and port employees. Based upon CBP's chosen criterion of 2000 hours in a year as the maximum time of exposure, neither CBP Officers, port employees, nor the general public will experience a cumulative dose greater than 0.05 mrem (50 µrem) in any one hour. The radiation dose from HCV-2 and Mobile Eagle® will be limited to no more than 0.05 mrem (50 µrem) in any one hour through the establishment of controlled areas. Analysis shows that exposures are expected to be well below NRC and Occupation Safety and Health Administration (OSHA) prescribed limits;

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therefore, the health and safety impacts from radiological exposure were found to not be significant.

Summary of Mitigation Actions Planned

Mitigation Measures for Air - To reduce emissions from the Proposed Action, cargo container handling equipment waiting for the inspection of containers by the HCV-2 and Mobile Eagle® will follow federal and state regulations regarding the control of idling times. The HCV-2 and Mobile Eagle® are 2006-2007 model vehicles and include the Best Available Control Technology as defined by the U.S. Environmental Protection Agency (EPA).

Mitigation Measures for Wastes - To preclude any significant impact petroleum, oils, or lubricants (POL) will be stored, handled, and disposed of in accordance with generally acceptable industry standards. Procedures for the safe refueling of HCV-2 and Mobile Eagle® and for the containment and clean-up of potential spills will be in accordance with existing Ports' and CES's operations. CBP personnel will be trained in spill prevention and countermeasures as required by the Resource Conservation and Recovery Act (RCRA) (42 U.S.C. §6901, et seq.) and the Oil Pollution Act of 1990 (OPA-90) (33 U.S.C §2701 et seq.)

Mitigation Measures for Radiological Health and Safety - Safety warnings and precautions, as directed by the CBP Radiation Safety Office, are incorporated into technical manuals to ensure operator personnel, and the general public at large, are not exposed to harmful levels of radiation. During routine use of equipment that produces radiation, standard precautions, supervision, and training will be employed to ensure that no humans are inadvertently harmed.

Radiation Controlled Area

Controlled Area is defined by 10 CFR 20.1003 as "*an area, outside of a restricted area but inside the site boundary, access to which can be limited by the licensee for any reason*". In order to limit the cumulative radiation dose to no more than 0.05 mrem (50 µrem) in any one hour, CBP establishes controlled areas for the HCV-2 and Mobile Eagle®. No personnel are allowed in the controlled areas during scanning operations. In comparison, the exposure allowable to a person from the operation of a television receiver is 500 µrem in any one hour (see 21 CFR 1020.10).

CBP has elected to use the term "controlled area" rather than "restricted area" as the scanning systems are not in continuous scanning mode. Further, the traditional wording of restricted area has other uses on the Ports and CES and does not accurately describe the caution, which the NRC and CBP desire to show the public. CBP has informed the NRC of the use of this terminology.

The dimensions for the controlled area for HCV-2 when operating at 3.8 MeV are 110 feet in length, 82 feet in width, and 82 feet in height. The dimensions for the controlled area for HCV-2 when operating at 4.2 MeV are 135 feet in length, 133 feet in width, and 133 feet in height. The dimensions of the Mobile Eagle® controlled area are 108 feet in length, 142 feet in width and 142 feet in height. At the edges of these controlled areas, the radiation dose will not exceed 0.05 mrem (50 µrem) in any one hour. Controlled area dimensions may be adjusted when needed by aiming the beam of the system over a sea wall, using cargo

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containers as a backstop, or by using masonry walls. The controlled area would only be adjusted under the supervision of the CBP Radiation Safety Officer and not to exceed the 50 μ R in any one hour limit.

Radiation Safety Engineering Controls

Safety warnings and precautions are incorporated into technical manuals to ensure operator personnel, and the general public at large, are not exposed to harmful levels of radiation. During routine use of equipment that produces radiation, standard precautions, supervision, and training will be employed to ensure that no humans are inadvertently harmed.

CBP Officers will act as ground guides for the driver of the HCV-2 and Mobile Eagle[®]. In addition to providing steering corrections, they will be positioned to observe cargo and personnel movements in the vicinity of the HCV-2 and Mobile Eagle[®] and alert the driver to avoid an accident. These Officers will be located outside of the radiation controlled area.

The systems incorporate redundant safety controls such as emergency shutoff controls at several locations on the systems.

Personnel assigned to operate the HCV-2 or Mobile Eagle[®] will be specifically trained for safe x-radiation system operation according to the CBP Office of Training and Development standards. Training for the system operators will consist of lectures, courses and a written examination in basic radiation physics, radiation safety, biological effects of radiation, instrumentation, radiation control, and operating procedures during normal and emergency conditions.

In the event of an accident that results in the temporary inability to stop the production of x-rays, the CBP officer will stop the movement of the HCV-2 or Mobile Eagle[®] and no one will be allowed inside the controlled area until responding officials arrive or until the production of x-rays has ceased. A local High Energy X-Ray Inspection System Coordinator should be notified immediately of the situation. He/she shall notify the CBP Radiation Safety Officer. The Ports, CES and local CBP Officials will be notified of the situation.

Cumulative Impacts

Cumulative impact is defined by the Council on Environmental Quality in 40 CFR 1508.7 as *the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.*

As part of a comprehensive mix of technologies, CBP currently operates Mobile and Pallet Vehicle and Cargo Inspection System (VACIS[®]) Gamma Imaging Inspection Systems at the Port of Los Angeles, Port of Long Beach and Carson CES, and Radiation Portal Monitors at the Port of Los Angeles and Long Beach. As with these systems, the HCV-2 and Mobile Eagle[®] and associated controlled areas will be separated from other non-intrusive inspection (NII) operating areas, adjacent structures, work areas and traffic flows to protect workers, the general public and contents of adjacent buildings.

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CBP plans to replace two of the existing Mobile VACIS® with two of the HCV-2's evaluated in this EA. The addition of these systems have not been found to significantly increase levels of air emissions at the Ports.

Impacts to the human environment from the Proposed Action would not be expected to be cumulatively significant. There are no other known projects or actions planned either on or in the immediate vicinity of the Ports or CES.

If new NII equipment is added to the Ports or CES, it will also be separated from adjacent structures, work areas and traffic flows to protect workers, the general public and contents of adjacent buildings. The amount and type of radioactive material used and radiation generated will define the controlled area around each NII site. The controlled areas will not overlap. By controlling access to these controlled areas, CBP will ensure that radiation exposure is kept as low as possible and is not cumulative in its effects.

If CBP determines that future procurements of NII systems are warranted, they will be evaluated in separate "Action Specific" EAs.

Findings and Conclusions

The evaluation of the Proposed Action, fielding and operation of four HCV-2's and one Mobile Eagle® at the Port of Los Angeles and Long Beach and Carson CES indicates that the physical and socioeconomic environments at the Ports and CES will not be significantly affected.

Implementation of the Proposed Action, coupled with the identified mitigation measures, will result in no significant, long term effects on the quality of the natural or human environment. An Environmental Impact Statement is not required and will be prepared. Issuance of a Finding of No Significant Impact is appropriate.

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EXPOSURE

1 Introduction

This Environmental Assessment (EA) addresses the potential environmental effects, beneficial and adverse, of the fielding and operation High-Energy Mobile X-Ray Inspection Systems by the U.S. Customs and Border Protection (CBP) at the Port of Los Angeles and Port of Long Beach and Carson CES, Los Angeles County, California.

Part of a comprehensive mix of technologies designed to complement one another and present a layered defense to smuggling attempts, High-Energy Mobile X-ray Inspection Systems allow CBP Officers to inspect for contraband without having to physically enter into or unload vehicles or containers. Congressionally funded and directed, High-Energy Mobile X-ray Inspection Systems fulfill NII technology requirements found in (1) The Office of National Drug Control Policy (ONDCP) *National Drug Control Strategy*; (2) The Office of National Drug Control Policy (ONDCP) *Ten Year Counterdrug Technology Plan and Development Roadmap*; (3) The CBP *Container Security Initiative*; (4) National Security Presidential Directive – 17/Homeland Security Presidential Directive – 4 *National Strategy to Combat Weapons of Mass Destruction*; (5) National Security Presidential Directive – 43/Homeland Security Presidential Directive – 14 *Domestic Nuclear Detection*; (6) *U.S. Customs and Border Protection 2005-2010 Strategic Plan* and (7) *The SAFE Ports Act of 2006*.

1.1 Background

The Department of Homeland Security was established in the aftermath of the terrorist attacks of September 11, 2001. The department has three primary missions:

- Prevent terrorist attacks within the United States,
- Reduce America's vulnerability to terrorism, and
- Minimize the damage from potential attacks and natural disasters.

CBP was assigned as an agency within the Department of Homeland Security on March 1, 2003, combining employees from the Department of Agriculture, the Immigration and Naturalization Service, the Border Patrol and the U.S. Customs Service. As the Nation's principal border agency, CBP has the responsibility to ensure economic security through lawful international trade and travel.

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CBP's mission of economic and border security is accomplished through physical inspection of cargo, conveyances, and persons as they enter the country. In conducting these inspections, CBP intercepts large quantities of contraband at the seaports and Ports of Entry (POEs). For example, in Fiscal Year 2002 alone, a total of 1,374,100 pounds of marijuana, 167,800 pounds of cocaine, and 4,100 pounds of heroin were seized nationally by CBP (USCBP, 2002). To improve the inspection process, CBP continuously seeks technological solutions that are cost effective and are safe for both humans and the environment.

A method of conducting inspections involves the use of non intrusive inspection (NII) techniques, which employ technologies such as x-ray or gamma radiation sources to "see" into cargo containers and identify potential contraband.

The effective and efficient screening and processing of cargo, conveyances, and persons will allow CBP Officers to focus the bulk of its anti-smuggling and trade enforcement resources on suspected and actual law violators, thereby increasing both the potential and the reality of detection. Strategically placing these systems at seaports and POEs will provide an effective barrier along the borders and will force smugglers to take higher risks to bring contraband into the U.S., increasing the chance of interception (USCS, 1999).

1.2 Purpose and Need

The purpose of the Proposed Action is the fielding and operation of five High-Energy Mobile X-Ray Inspection Systems at Port of Los Angeles and Port of Long Beach, Los Angeles County, California, for the purpose of conducting non intrusive inspections (NIIs) of high-density cargo containers for contraband such as illicit drugs, currency, guns, and weapons of mass destruction. For the purposes of this environmental analysis, high-density cargoes and containers are defined as having a density greater than 6 inches of steel.

The need of the Proposed Action is to assist in fulfilling the requirement for the 100% scanning of containers entering the United States directed in the SAFE Ports Act of 2006 (H.R. 4954). Because of the sheer volume of sea container traffic and the opportunities it presents for terrorists, containerized shipping is uniquely vulnerable to terrorist attack. The Port of Los Angeles is the busiest container port in the United States and the eighth busiest container port in the world (Port of Los Angeles, 2005a) During the period of January-December 2004, the Port of Los Angeles moved 7,321,440.10 Twenty-foot Equivalent Units (TEUs) through the port; a 1.98% increase in, or 142,500 more, TEUs than 2003 (Port of Los Angeles, 2005b). The Port of Long Beach is the second busiest container port in the United States and the twelfth busiest container port in the world (Port of Long Beach, 2003). During the period of January-December 2004, the Port of Long Beach moved 5,779,852 TEUs through the port; a 24% increase in, or 1,121,728 more, TEUs than 2003 (Port of Long Beach and U.S. Department of Commerce, 2005). In order to effectively inspect high-density cargoes and containers, NII candidates must be able to provide penetration of greater than 6 inches of steel.

The systems will be stored at the Carson Container Examination Station (CES) and moved to and operated at any area of the ports suitable for conducting inspections as required.

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1.3 Public Involvement

In keeping with established policy regarding an open decision-making process, this EA and resulting decision document of either a Finding of No Significant Impact (FONSI) or a Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) will be made available to agencies and the general public for review and comment. A Notification of Availability (NOA) will be published in applicable local newspapers and copies of the EA made available to the general public at local libraries and public review website: <http://aerc.swf.usace.army.mil/Pages/Publicreview.cfm>.

For further information on the Proposed Action or to request a copy of the EA, please contact Ms. Sharon Sharp-Harrison, Branch Director, Office of Information and Technology, Laboratories and Scientific Services, Interdiction Technology Branch, 1300 Pennsylvania Avenue, NW, Suite 1575, Washington, DC 20229.

1.4 Framework for Analysis

This EA was prepared in compliance with the National Environmental Policy Act (NEPA), (Public Law 91-190, 42 U.S.C. 4321-4347, as amended), the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500-1508) and Department of Homeland Security Procedures Relating to the Implementation of the National Environmental Policy Act (71 FR 16790-16820, April 4, 2006).

This EA is intended to be a concise public document that provides sufficient evidence and analysis for determining whether to prepare an EIS or a FONSI. NEPA requires that agencies of the federal government implement an environmental impact analysis program in order to evaluate "...major federal actions significantly affecting the human environment".

In addition to the evaluation for potential direct and indirect impacts, the Proposed Action was also evaluated for cumulative impacts on the environment as described later in Section 4, "Cumulative Impacts", of this EA.

1.5 Description of High-Energy Mobile X-Ray Inspection Systems

Representative photographs of the HCV-2 are shown in Figures 1 and 2. Representative photographs of the Mobile Eagle® are shown in Figures 3 and 4.

The High Energy Mobile X-Ray Inspection Systems employ an x-ray source to produce images of tankers, commercial trucks, sea and air containers, and other vehicles for contraband such as drugs, explosives, and weapons. The systems are able to scan vehicles in one pass. The systems are mounted on a truck chassis and operated by a three-man crew. The systems operate by slowly driving past a parked vehicle or cargo container with the boom extender over the target vehicle or container. When deployed for scanning operations the HCV-2 is approximately 18.33 feet high, 29.0 feet wide, and 34.5 feet long and the Mobile Eagle® is approximately 17.5 feet high, 25.6 feet wide, and 40 feet long. No radiation source material is used to produce images.

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Detector and Source Boom Assembly

The detection boom is aligned with the x-ray emission subsystem, and when deployed, forms the complete detection subsystem. The detection boom comprises of an L-shaped detection line made up of a series of detectors that convert the x-ray emissions produced by the accelerator, into an electronic signal. These detectors are placed along the length of a rigid metal structure, which is enclosed in a casing.

Imaging System

The High Energy Mobile X-Ray Inspection Systems utilize a Varian linear accelerator to produce the x-ray emissions to the detector box assembly. The High Energy Mobile X-Ray Inspection Systems use an electric power generator to provide the electric power supply during scanning operations.

Radiation Safety Features

Operator Controls and Displays

The High Energy Mobile X-Ray Inspection Systems are equipped with the operator controls and displays required for scanning targets and for the review of the images acquired from the scan. The x-ray linear accelerator is controlled through these interfaces when performing inspections. An Emergency Stop "E-Stop" Switch can immediately stop all operations, including x-ray production when activated.

Radiation Controlled Area

CBP establishes controlled areas around each High Energy Mobile X-Ray Inspection System which help limit the potential doses to CBP personnel and the public to below 50 μ R in any one hour. The dimensions for the controlled area for HCV-2 when operating at 3.8 MeV are 82 feet in width, 110 feet in length, and 82 feet in height, as shown in Figure 5. The dimensions for the controlled area for HCV-2 when operating at 4.2 MeV are 135 feet in length, 133 feet in width, and 133 feet in height, as shown in Figure 6. The dimensions of the Mobile Eagle[®] controlled area are 108 feet in length, 142 feet in width and 142 feet in height, as shown in Figure 7. At the edges of these controlled areas, the radiation dose will not exceed 0.05 mrem (50 μ rem) in any one hour. No personnel will be allowed in the radiation controlled area during scanning operations. Controlled area dimensions may be adjusted when needed by aiming the beam of the system over a sea wall, using cargo containers as a backstop, or by using masonry walls. The controlled area would only be adjusted under the supervision of the CBP Radiation Safety Officer and not to exceed the 50 μ R in any one hour limit.

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Image Source: CBP

Figure 1: HCV-2 (Stowed Configuration)

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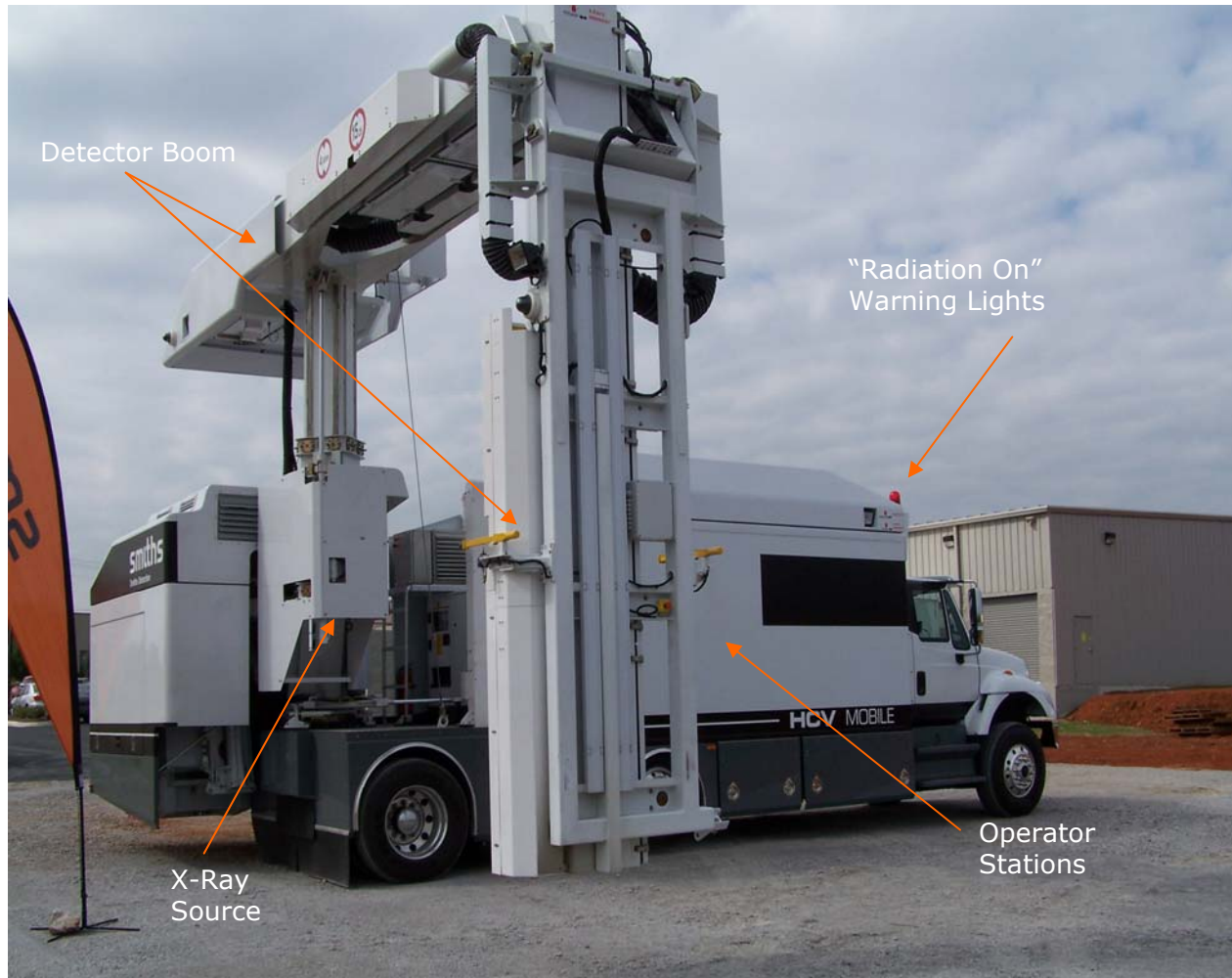


Image Source: CBP

Figure 2: HCV-2 (Deployed Configuration)

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Image Source: CBP

Figure 3: Mobile Eagle® (Stowed Configuration)

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(Source: Rapiscan, 2006)

Figure 4: Mobile Eagle® (Deployed Configuration)

2 The Proposed Action and Alternatives

Under NEPA, the proponent for an action is responsible for considering a reasonable range of alternatives for achieving a goal or implementing a project or program. This section provides a description of the Proposed Action and alternatives considered in order to identify potentially affected environments and potential impacts to these environments. Two action scenarios were evaluated in the EA.

1. Fielding and Operation of High-Energy Mobile X-Ray Inspection System
2. The No-Action Alternative

Fielding and Operation of the High-Energy Mobile X-Ray Inspection was chosen as the preferred alternative and is presented as the Proposed Action, in this EA, along with the No Action Alternative.

2.1 Alternative 1 – Proposed Action

The Proposed Action is to field and operate four HCV-2 and one Mobile Eagle® High-Energy Mobile X-Ray Inspection Systems at the Ports of Los Angeles and Long Beach for the purpose of conducting NII of high-density cargo containers entering the United States. The systems will be stored at the Carson Container Examination Station (CES) and moved to and operated at any area of the ports suitable for conducting inspections as required.

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2.2 Alternative 2 – No Action/Status Quo

The No Action Alternative is the status quo, to visually, and using gamma imaging inspection systems, inspect the cargo containers for the presence of persons or indications of the presence of contraband. If the CBP Officer detects or believes that persons or contraband may be present, the entire cargo container in question is manually inspected or offloaded. Although the No Action Alternative does not meet the purpose and need, it serves as a basis of comparison to the Proposed Action and other alternatives.

2.3 Other Alternatives Considered

Two additional alternatives were found to be reasonable for providing CBP with the capability to inspect containers with high-density cargoes.

3. Mid Energy X-Ray Inspections Systems ($0.25 < 2 \text{ MeV}$);
4. Gamma Imaging Inspection Systems ($\text{Cs}^{137}/\text{Co}^{60}$)

Each of the alternatives was evaluated on its ability to provide the required functional capability to support the CBP mission. Alternative (3), Mid-Energy X-Ray Inspection Systems, and Alternative (4), Gamma Imaging Inspection Systems, were determined to not be functionally viable in meeting the mission requirement for penetration of high-density cargo and therefore were not carried forward for detailed analysis.

Section

3

3 The Affected Environment and Consequences

This section describes the current condition of environmental resources and the possible impacts to these resources from the Proposed Action and alternatives. The descriptions represent baseline conditions for the comparison of changes caused by implementation of the Proposed Action and alternatives. Potential changes or impacts to the resources are described in each section as potential consequences. Cumulative impacts, or impacts attributable to the Proposed Action combined with other past, present or reasonably foreseeable future impacts regardless of the source, are presented in Section 4.

The Proposed Action is to be fielded at the Ports of Los Angeles and Long Beach and stored at the Carson CES, Los Angeles County, California. The Port of Los Angeles is the busiest container port in the United States and the eighth busiest container port in the world (Port of Los Angeles, 2005a). During the period of January-December 2004, the Port of Los Angeles moved 7,321,440.10 Twenty-foot Equivalent Units (TEUs) through the port; a 1.98% increase in, or 142,500 more, TEUs than 2003 (Port of Los Angeles, 2005b). The Port of Long Beach is the second busiest container port in the United States and the twelfth busiest container port in the world (Port of Long Beach, 2003). During the period of January-December 2004, the Port of Long Beach moved 5,779,852 TEUs through the port; a 24% increase in, or 1,121,728 more, TEUs than 2003 (Port of Long Beach and U.S. Department of Commerce, 2005).

3.1 Preliminary Impact Scoping

The preliminary impact scoping table shows the resources that could potentially be affected by the Proposed Action or are of public concern. Only those resources that will be impacted by the Proposed Action are discussed further in the section. Table 1 presents the results of the preliminary impact scoping and explains why certain resources were excluded from discussion. Affected environments with a "Y" will be discussed in detail and those marked with "N" have been found to have minimal or no significant impact and are not discussed further in the EA.

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Table 1: Preliminary Impact Scoping Table

<i>Resource</i>	<i>Potential for Impact</i>	<i>Retained (Y/N)</i>
Climate	The Proposed Action will not have an impact on the climate of the Ports of Los Angeles or Long Beach, Carson CES or Los Angeles County, California.	N
Geology and Soils	There is no construction or excavation relative to the Proposed Action. The systems are mobile and can be moved as needed. Seismic hazards related to liquefaction and ground shaking would have minimal impact on the High Energy Mobile X-Ray Inspection systems. No direct impacts to geology and soils would occur from the implementation of the Proposed Action. Further evaluation is not warranted.	N
Hydrology and Water Quality	The Proposed Action will not affect hydrology, water resources or water quality.	N
Floodplain	There are 100 and 500 year floodplains located at the Ports of Los Angeles and Long Beach. The Carson CES is not located in a floodplain. In accordance with Executive Order 11988 "Floodplain Management", CBP has determined that there are no reasonable alternatives to locating and operating the Proposed Action in a designated floodplain. The systems are mobile and therefore able to be moved outside the flood zone area if required. The Proposed Action will not endanger life, will not impair the ability of the designated floodway to carry and discharge the waters of a base flood and will not increase flood levels within the community during the occurrence of the base flood discharge. Further evaluation is not warranted.	N
Wetlands	The Proposed Action will not be located in a wetland. The Proposed Action will occur on previously paved surfaces at the Ports and CES. No wetlands will be impacted by the Proposed Action.	N

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<i>Resource</i>	<i>Potential for Impact</i>	<i>Retained (Y/N)</i>
Coastal Zone	The Port of Los Angeles and Port of Long Beach are located in the California Coastal Zone. The Carson CES is located outside of the California Coastal Zone. The Proposed Action is consistent with the purposes and functions inherent in the safe operation of California's ports and the expeditious movement of commerce through the Ports of Los Angeles and Long Beach and is not reasonably likely to affect any land or water use, or natural resource of the state's coastal zone. No further evaluation is warranted.	N
Vegetation and Wildlife	The HCV-2's and Mobile Eagle® will be operated and stored on existing asphalt and concrete surfaces designed and designated for the movement of cargo and goods through the Ports of Los Angeles and Long Beach. The Proposed Action is consistent with current actions at the Ports and CES. The Proposed Action will not have an adverse impact on vegetation or wildlife resources in the area. No further evaluation is warranted.	N
Threatened and Endangered Species	The HCV-2's and Mobile Eagle® will be operated and stored on existing asphalt and concrete surfaces designed and designated for the movement of cargo and goods through the Ports of Los Angeles and Long Beach. An area of Pier 400 at the Port of Los Angeles has been dedicated as critical nesting habitat for the California Least Tern (<i>Sterna antillarum browni</i>). The critical nesting habitat is located outside of the operational area of the Port. The Proposed Action will not impact the California Least Tern or any other threatened and endangered species. No further evaluation is warranted.	N

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<i>Resource</i>	<i>Potential for Impact</i>	<i>Retained (Y/N)</i>
Air Quality	The Ports of Los Angeles and Long Beach and Carson CES are located in Los Angeles County, California. The sites are located in the Los Angeles South Coast Air Basin, CA. Los Angeles County is classified as severe 17 nonattainment for ozone, serious nonattainment for carbon monoxide and serious nonattainment for PM10 and nonattainment for PM 2.5 (EPA, 2006). Air quality impacts associated with the Proposed Action would be limited to localized effects associated with emissions generated by the HCV-2's and Mobile Eagle® and any idling vehicles during operations. Although emission levels are expected to be well below prescribed limits, further evaluation is warranted.	Y
Noise	The Proposed Action is consistent with current actions at the Ports and CES. The systems are placed on trucks similar to vehicles already present at the Ports and CES. The Proposed Action will not exceed any of the pre-existing noise conditions nor limit requirements. As a result, the Proposed Action will not have a significant noise impact on nuisance noise regulated by local governments. No further evaluation is warranted.	N
Land Use and Zoning	The Proposed Action will not impact land use or zoning. The Proposed Action is consistent with current land use and zoning practices at the Ports and CES. No further evaluation is warranted.	N
Aesthetics and Visual Resources	The Proposed Action would not obscure or result in abrupt changes to the complexity of the landscape and skyline when viewed from points readily accessible to the public. The Proposed Action is consistent with current actions at the Ports and CES. No long-term change to the character of the area would occur as a result of the Proposed Action. No further evaluation is warranted.	N
Infrastructure/Utilities	Sufficient utility capacity already exists at the Ports and Carson CES to adequately accommodate the Proposed Action. The systems will not use the utilities of the Ports or CES for operation. The Proposed Action will not affect the infrastructure and utility services of the surrounding areas. No further evaluation is warranted.	N

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<i>Resource</i>	<i>Potential for Impact</i>	<i>Retained (Y/N)</i>
Traffic / Transportation	<p>The Ports are already equipped with existing roadways and parking lots for both cars and heavy trucks and cargo containers.</p> <p>The Proposed Action will not impact the parking and accessibility to the Ports of Los Angeles or Long Beach or Carson CES and will not impact the flow of traffic in and out of the Ports. No further evaluation is warranted.</p>	N
Waste Management	<p>Wastes associated with the Proposed Action are lubricants for the operation and maintenance of the HCV-2's and Mobile Eagle®. These lubricants will be accumulated in approved containers at or near the point of generation and recycled for use again by a licensed waste recycling company. 40 CFR 279 exempts used lubricants from consideration as hazardous waste if it is managed through a used oil recycler and is not mixed with any other hazardous wastes. The operation and maintenance of the HCV-2's and Mobile Eagle® would not result in generation rates that would exceed 100 kilograms (220 pounds) of waste in any calendar month (Conditionally Exempt Generator). No further evaluation is warranted.</p>	N
Historic and Archeological (Cultural) Resources	<p>Activities associated with the Proposed Action are related to operation of the HCV-2's and Mobile Eagle® in an industrial setting and will not have an impact on sites which are listed on, or potentially eligible for listing on, the National Register of Historic Places. There are no known archeological resources within Ports or Carson CES associated with the Proposed Action. There is no construction or excavation related to the Proposed Action. Implementing the Proposed Action will not have a significant impact on cultural or historic resources. No further evaluation is warranted.</p>	N
Socioeconomic	<p>The Proposed Action will not alter the population distribution or growth rates or have any short- or long-term effects on the socioeconomics of the region. No further evaluation is warranted.</p>	N
Environmental Justice	<p>Implementation of the Proposed Action will not have any negative effect on minority and low-income populations or children. No further evaluation is warranted.</p>	N

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<i>Resource</i>	<i>Potential for Impact</i>	<i>Retained (Y/N)</i>
Irreversible and Irretrievable Commitment of Resources	Irreversible and irretrievable commitment of resources associated with the Proposed Action will be materials, utilities, labor and time expended to the operation of the HCV-2's and Mobile Eagle®.	N
Radiological Health and Safety	Radiological impacts associated with the Proposed Action have the potential to impact the health and safety of operators, officers, and the general public. Although exposures are expected to be well below the EPA and OSHA prescribed limits, further evaluation is warranted.	Y

3.2 Air Quality

3.2.1 Criteria for Significance

A determination of significant impact on air quality could result if any of the following conditions are anticipated to occur:

- Activities would release criteria pollutants that exceed National Ambient Air Quality Standards (NAAQS)
- Activities are not in conformity with Section 176 of the Clean Air Act for Federal actions or approved State Implementation Plan.

3.2.2 Baseline Environment

The Ports of Los Angeles and Long Beach and Carson CES are located in Los Angeles County, California. The sites are located in the Los Angeles South Coast Air Basin, CA. Los Angeles County is classified as severe 17 nonattainment for ozone, serious nonattainment for carbon monoxide and serious nonattainment for PM10 and nonattainment for PM 2.5 (EPA, 2006).

3.2.3 Potential Consequences

3.2.3.1 Proposed Action - Fielding and Operation of High-Energy Mobile X-Ray Inspection Systems

Minimum vehicle emissions will be produced by idling of the High Energy Mobile X-Ray Inspection Systems to operate the scanning equipment to perform the screening of cargo containers. A conformity review is required according to 40 CFR 93.153 for areas that are not in attainment with NAAQS. See Appendix B for these calculations.

In November 1993, the EPA published the General Conformity Final Rule in the Federal Register (58 FR 63214). The purpose of the rule, "Determining Conformity of General Federal Actions to State and Federal Implementation Plans" is to ensure that all Federal

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actions conform to the State Implementation Plan (SIP) applicable to the project site. The applicable regulations are cited in 40 CFR Part 6, Part 51 (Subpart W), and Part 93. A "federal action" is defined as any action engaged in by the federal government, or any activity that a department, agency, or instrumentality of the federal government supports by providing financial assistance, licenses, permits, or approval in any way.

"Conformity to SIP" is defined as conformity to a SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards. As a result of the General Conformity Rule, federal actions must be evaluated to assess whether emissions associated with the action will interfere with the area's air quality improvement plan. The general conformity rule applies only to federal actions that may emit a criteria pollutant for which an area has been designated as non-attainment or maintenance.

All emission levels from the activities associated with the Proposed Action are below the tons/year *de minimus* threshold values for all pollutants as specified by the U.S. Environmental Protection Agency (EPA) in 40 CFR 93.153(b)(1)-(2). Further procedural requirements under the General Conformity Rule are therefore not applicable and the Proposed Action is anticipated to have a less than significant impact on local or regional air quality. See Appendix B for the emissions estimates for the Proposed Action.

3.2.3.1.1 Mitigation Measures

To reduce emissions from the Proposed Action, cargo container handling equipment waiting for the inspection of containers by the HCV-2 and Mobile Eagle® will follow federal and state regulations regarding the control of idling times. The HCV-2 and Mobile Eagle® are 2006-2007 model vehicles and include the Best Available Control Technology as defined by the U.S. Environmental Protection Agency (EPA).

3.2.3.2 No Action Alternative

No change in existing ambient air quality would occur and no new pollution sources would be introduced. The No Action Alternative includes visually inspecting cargo containers and inspecting using gamma imaging inspection systems. The effects to air quality resulting from the operation of gamma imaging inspection systems were evaluated in the *Environmental Assessment for Gamma Imaging Inspection Systems at the Port of Los Angeles, Port of Long Beach, Carson Container Examination Station, Los Angeles County, California, January 2007* and found to not be significant. No impact to air quality is anticipated.

3.3 Radiological Health and Safety

3.3.1 Criteria for Significance

Evaluation of the potential effect of radiation exposure on public safety is based on both the potential for an accident and the consequences of any project-related effect associated with normal operations. Beneficial impacts may result from any direct or indirect safety improvements due to project implementation. An alternative could have a significant impact if it would increase or decrease the risk of exposure of personnel or the public to radiation hazards.

3.3.2 Baseline Environment

3.3.2.1 Ionizing Radiation

Radiation is the most complex of all considerations pertaining to the operation of the HCV-2's and Mobile Eagle®. The focus of this section, Radiation Health and Safety, is "ionizing radiation". See Appendix C for background information on ionizing radiation.

The HCV-2 and Mobile Eagle® employ advanced high-energy digital x-ray imaging technology that have successfully been used in such critical applications as field inspection of structures like bridges and buildings. As radiation-producing devices, these systems are subject to review by radiation protection authorities. These include the Occupational Safety and Health Administration (OSHA), the Food and Drug Administration (FDA), and the California Department of Health Services.

During normal operating conditions, the affected environment includes the area surrounding the cargo containers being scanned by the HCV-2 and Mobile Eagle®. System operators and maintainers, as well as people in the area around the HCV-2 and Mobile Eagle® are the key component of the affected environment. For purposes of discussion, people are classified into two categories:

1. Maintenance personnel
2. General public (including system operators)

All maintenance personnel are employees of the equipment manufacturer. Due to the nature of their jobs, they have the potential to be exposed to a higher level of radiation than system operators and members of the general public.

For its Officers, Port employees and truck drivers, CBP has adopted the same effective radiation dose standard that the Nuclear Regulatory Commission (NRC) and the State of California prescribe for members of the general public (i.e., 0.1 rem (100 mrem, 100,000 µrem) in a year). These personnel do not pass through the beam during scanning operations.

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3.3.3 Potential Consequences

3.3.3.1 Proposed Action - Fielding and Operation of High-Energy Mobile X-Ray Inspection Systems

3.3.3.2 Exposure Pathways

The radiation exposure pathway for the general public is created from exposure to scattered radiation from the x-ray source during container scanning operations. However, in all cases, the radiation dose received by the general public will not exceed 0.1 rem (100mrem, 100,000 μ rem) in a year. No personnel will be allowed inside of the radiation controlled area during scanning operations.

3.2.3.3 Normal Operations

Human Exposure

All maintenance personnel who maintain the linear accelerator (linac) and x-ray source components are employees of the equipment manufacturer. By the nature of their jobs, they have the potential to be exposed to a higher level of radiation than the system operators and members of the general public. Maintenance of the linac and x-ray source components will have to comply with the EPA, OSHA, and State of California's strict dose standards for Radiation Workers. For a more detailed discussion of dose standards, see Appendix C.

The HCV-2 and Mobile Eagle[®] are designed so that the radiation dose levels within the driver's cab and at the inspector work-stations (Systems Operators) will be below the CBP prescribed limits of 100 mrem in a year. Detailed radiation surveys, performed by or under the supervision of the CBP Radiation Safety Office, have confirmed that these design criteria have been met. In all cases, exposures were measured using a "worst-case" scatter in the x-ray beam. Furthermore, since such a worst-case scatter scenario is not likely to occur, these estimated exposure levels are conservative by a substantial amount. In any case, as the HCV-2 and Mobile Eagle[®] are delivered, exposure measurements will be made in all cabs and work-station areas to ensure that the system is in compliance with exposure limits.

For its Officers, CBP has adopted the same effective radiation dose standard that the Nuclear Regulatory Commission (NRC) and the State of California prescribe for members of the general public (i.e., 0.1 rem (100 mrem, 100,000 μ rem) in a year). CBP has adopted the NRC standard because the OSH Act only addresses occupational dose exposure limits. Although CBP Officers are "occupationally exposed", as defined by the International Commission on Radiological Protection (ICRP) (ICRP, 2007) because their assigned duties involve exposure to radiation or to radioactive material, CBP has decided to limit their "occupational dose" to no more than that allowable for members of the public. The reason that CBP can do this is because x-rays and gamma rays of the same energy and intensity have the same effect on human tissue (and other materials).

This limit applies to all CBP employees or contractors who work or maintain the HCV-2 or Mobile Eagle[®], but not the linac or x-ray source components. This means that, as far as radiation dose standards are concerned, HCV-2 and Mobile Eagle[®] operators are the same as members of the general public. For a more detailed discussion of dose standards, see

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Appendix C. Occupational exposure, to the effective radiation dose standard CBP has adopted, is not expected to cause a significant increase in the risk of cancer. For a more detailed discussion of information concerning risks from occupational radiation exposure, see Appendix D.

To meet the threshold radiation dose limit, CBP establishes controlled areas for the HCV-2 and Mobile Eagle[®]. No personnel are allowed in the controlled areas during scanning operations. The dimensions for the HCV-2 operating at 3.8 MeV are 110 feet in length, 82 feet in width, and 82 feet in height as depicted in Figure 5. The dimensions for the controlled area for HCV-2 operating at 4.2 MeV are 135 feet in length and 133 feet in width and 133 feet in height, as depicted in Figure 6. The dimensions for the controlled area for the Mobile Eagle[®] are 108 feet in length, 142 feet in width and 142 feet in height, as depicted in Figure 7. At the edges of these controlled areas the radiation dose will not exceed 0.05 mrem (50 μ rem) in any one hour. The radiation dose of 50 μ rem in any one hour is inclusive of background radiation which accounts for approximately half (20-30 μ rem in any one hour) of the radiation dose. In other words, the radiation dose received from the HCV-2 and Mobile Eagle[®] is on the order of that received from natural background radiation. Controlled area dimensions may be adjusted when needed by aiming the beam of the system over a sea wall, using cargo containers as a backstop, or by using masonry walls. The controlled area would only be adjusted under the supervision of the CBP Radiation Safety Officer and not to exceed the 50 μ R in any one hour limit.

In the extreme, a system operator (or a member of the general public) could be situated at the edge of the controlled area 8 hours a day, every workday of the year (that is to say, 2,000 hours per year) and not receive more than the limits prescribed by the NRC and the State of California. The controlled areas ensure that the systems conform to the radiation protection guidelines of reducing the radiation levels As Low as is Reasonably Achievable (ALARA).

Given the engineering design features built into the HCV-2 and Mobile Eagle[®] and the implementation of a controlled areas, the impact of radiation to the operator, Port employees, and the general public would not be significant.

Effects of Irradiation on Food

CBP Radiation Safety Office has conducted tests to determine the worst case scenario of radiation doses to food as a result of implementing the Proposed Action. The total absorbed dose deposited in food subjected to scanning by a High Energy Mobile X-Ray Inspection System operating at 4.2 MeV (worst case) is approximately 2 mrad (2,000 μ rad) per scan, on the same order as that received by a stowaway. This dose is 180 times less than the average annual background dose in the U.S. of 360 mrad. The Food and Drug Administration at 21 CFR 179.21 requires a label be affixed to each machine stating that no food shall be exposed to x-ray radiation sources to receive an absorbed dose in excess of 0.5 grays (50 rads, 50,000 mrad, 50,000,000 μ rad). The High Energy Mobile X-Ray Inspection Systems' absorbed dose is 24,000 times less than this limit.

Based on these measurements and in compliance with the provisions of 21 CFR 179.21 it is concluded that radiation from the Proposed Action will have no significant impact on food that may be located in scanned containers.

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Maintenance

CBP personnel will not perform any maintenance of the linac or the x-ray source enclosure. CBP personnel will periodically perform maintenance of the detectors and test the system using procedures described in the Operator's Manual. Non-routine linac and x-ray source maintenance will be performed by the manufacturers.

Radiation Safety Engineering Controls

The HCV-2 and Mobile Eagle[®] incorporate redundant safety controls, such as emergency shutoff pushbutton controls at several locations on the systems. The personnel assigned to operate the systems will be specifically trained for safe x-radiation system operations according to CBP Office of Training and Development standards. Training for the HCV-2 and Mobile Eagle[®] operators will consist of lectures, courses and a written examination in basic radiation physics, radiation safety, biological effects of radiation, instrumentation, radiation control and operating procedures during normal and emergency conditions.

3.3.3.4 Abnormal Events

Effects of Irradiation on Persons (Stowaways)

As stated in Section 3.3.3.3 (Human Exposure), the NRC and the State of California have established the maximum allowable value of radiation dose that may be received by individuals (individual members of the general public) to be 0.1 rem (100 mrem, 100,000 μ rem) in a year.

It is possible that people will hide themselves in cargo containers in order to surreptitiously enter the United States. A stowaway concealed in a cargo container that is scanned by the HCV-2 or Mobile Eagle[®] will be exposed to radiation as a direct consequence of the inspection process.

The CBP Radiation Safety Officer conducted testing to determine the dose that a person hidden in a cargo container would experience during HCV-2 and Mobile Eagle[®] scanning operations. The total absorbed dose to stowaways subjected to scanning by a High Energy Mobile X-Ray Inspection System operating at 4.2 MeV (worst case) is approximately 2 mrem (2,000 μ rem) per scan, on the same order of that received by food. This dose is 180 times less than the average annual background dose in the U.S. of 360 mrem and 50 times below levels permissible to the general public. Neither cargo container drivers nor any other personnel pass through the beam during scanning operations.

Assuming 2 mrem (2,000 μ rem) per scan, to reach the maximum allowable "in a year" radiation dose, a person would have to be scanned 50 times in a year. Since the chance of this frequency of exposure is remote, it is concluded that radiation from the HCV-2 or Mobile Eagle[®] will not have a significant impact on persons located in scanned cargo containers.

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3.3.3.1.4 Mitigation Measures

Since CBP has chosen the upper permissible level of radiation dose of its personnel to be the same as that of the general public, CBP Officers are not designated as occupational radiation workers. CBP has chosen the criterion of 2000 hours per year as the maximum expected exposure time (i.e., 8 hours a day, five days a week, 50 weeks per year) for its personnel (which is considered the worst-case exposure regime for any individual, general public or otherwise). Based on this time of exposure, and based on the Public Dose criterion of 0.1 rem (100 mrem, 100,000 μ rem) in a year, a CBP Officer who is assigned at a High Energy Mobile X-Ray Inspection System operational site cannot experience a cumulative radiation dose greater than 0.05 mrem (50 μ rem) in any one hour.

Safety warnings and precautions are incorporated into technical manuals to ensure operator personnel, and the general public at large, are not exposed to harmful levels of radiation. During routine use of equipment that produces radiation, standard precautions, supervision, and training will be employed to ensure that no humans are inadvertently harmed.

Radiation Controlled Area

Controlled Area is defined by 10 CFR 20.1003 as *"an area, outside of a restricted area but inside the site boundary, access to which can be limited by the licensee for any reason"*. CBP has elected to use the term "controlled area" rather than "restricted area" as the scanning systems are not in continuous scanning mode. Further, the traditional wording of restricted area has other uses on the Ports and CES and does not accurately describe the caution, which CBP desires to show the public.

To meet the threshold radiation dose limit, CBP establishes controlled areas for HCV-2 and Mobile Eagle® systems. No personnel are allowed in the controlled areas during scanning operations. In comparison, the exposure allowable to a person from the operation of a television receiver is 500 μ rem in any one hour (see 21 CFR 1020.10).

The dimensions for the HCV-2 operating at 3.8 MeV are 110 feet in length, 82 feet in width, and 82 feet in height as depicted in Figure 5. The dimensions for the controlled area for HCV-2 operating at 4.2 MeV are 135 feet in length and 133 feet in width and 133 feet in height, as depicted in Figure 6. The dimensions for the Mobile Eagle® controlled area are 108 feet in length, 142 feet in width, and 142 feet in height, as depicted in Figure 7. At the edges of these controlled areas, the radiation dose will not exceed 0.05 mrem (50 μ rem) in any one hour. The radiation dose of 50 μ rem in any one hour is inclusive of background radiation which accounts for approximately half (20 -30 μ rem in any one hour) of the radiation dose. Controlled area dimensions may be adjusted when needed by aiming the beam of the system over a sea wall, using cargo containers as a backstop, or by using masonry walls. The controlled area would only be adjusted under the supervision of the CBP Radiation Safety Officer and not to exceed the 50 μ R in any one hour limit.

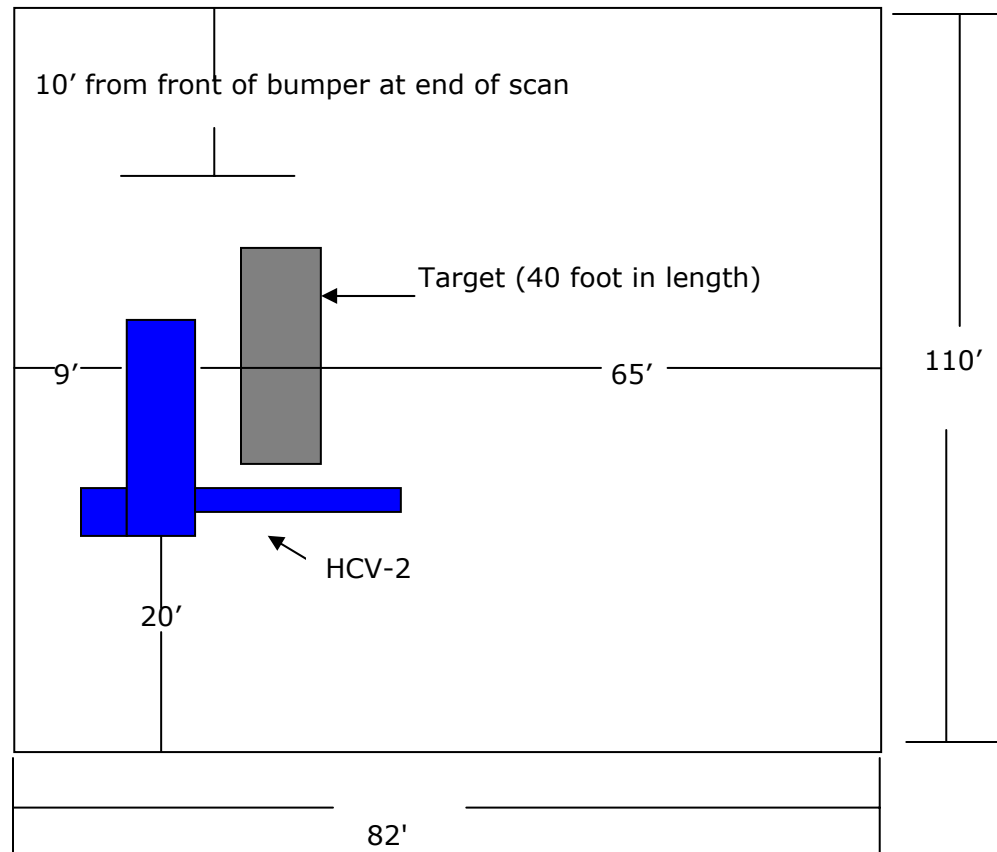
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3.3.3.2 No Action Alternative

The No Action Alternative is the status quo, to visually, and by using gamma imaging inspection systems, inspect the cargo containers for the presence of persons or indications of the presence of contraband. If the CBP Officer detects or believes that persons or contraband may be present, the container is directed to an area designated for the manual offloading and inspection of cargo. The radiation effects resulting from the operation of gamma imaging inspection systems were evaluated in the *Environmental Assessment for Gamma Imaging Inspection System Port of Los Angeles, Port of Long Beach, Carson Container Examination Station, Los Angeles County, California, January 2007* and found to not be significant.

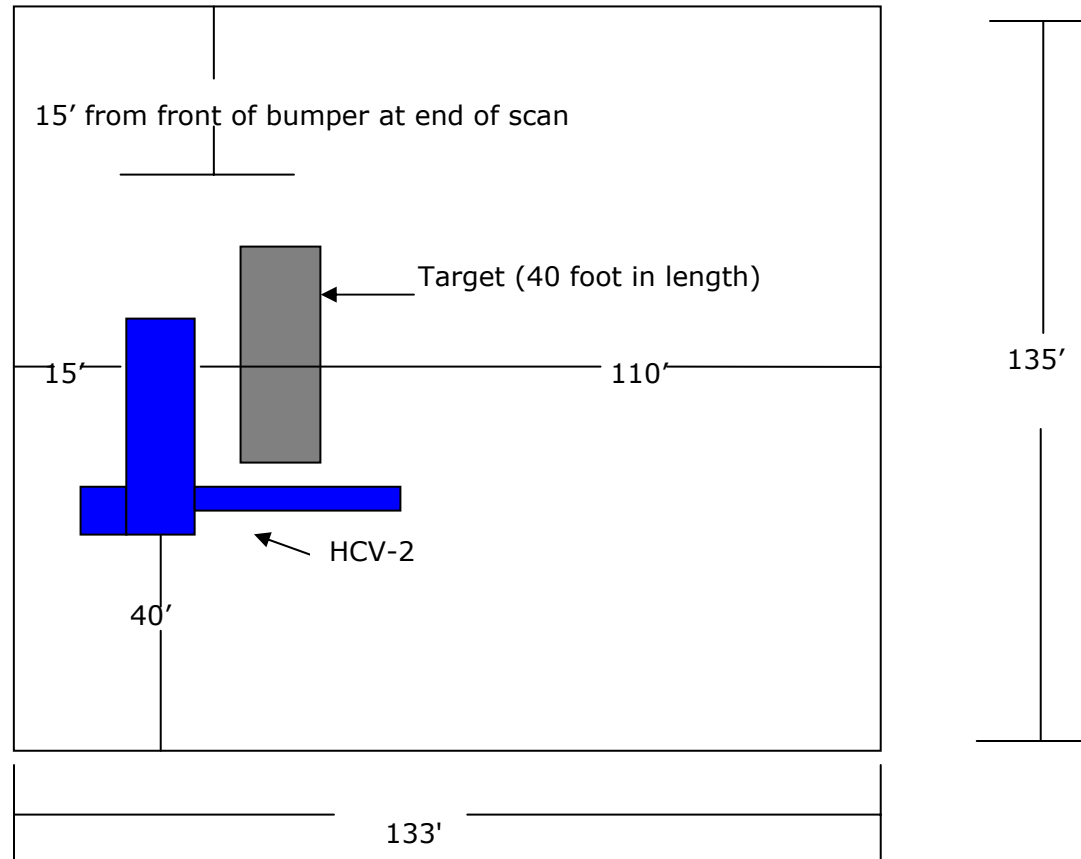
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Figure 5: HCV-2 Controlled Area For Operation At 3.8 MeV



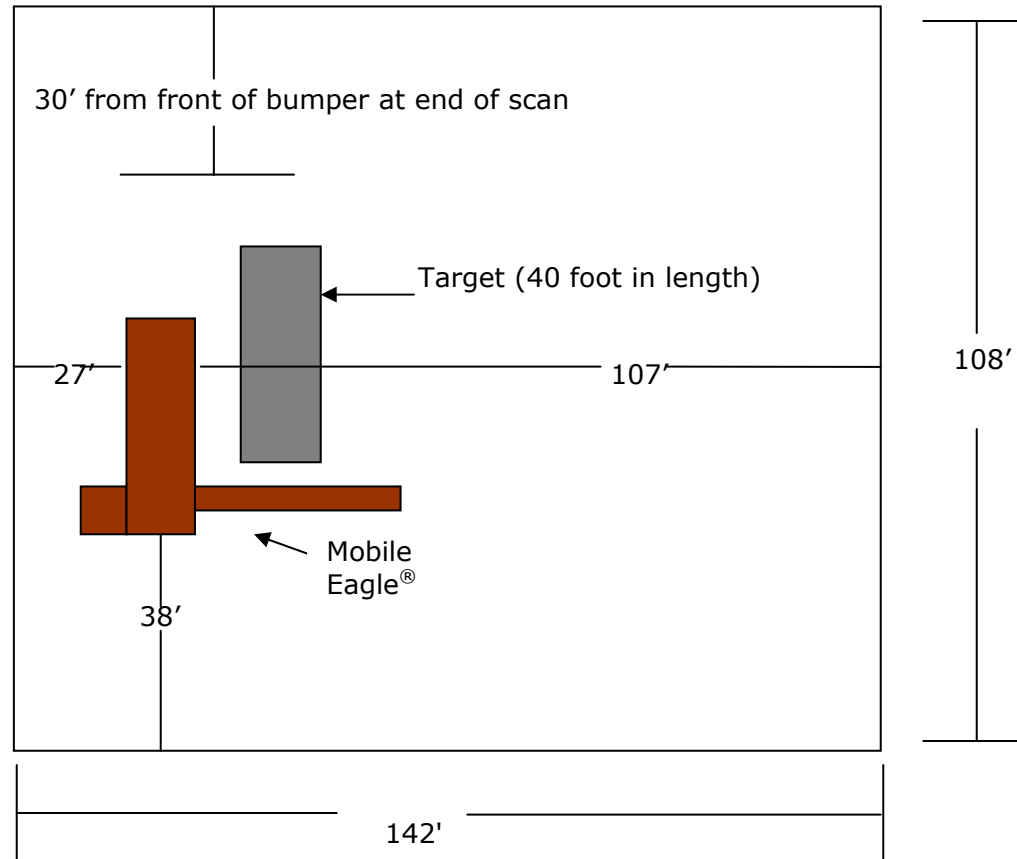
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Figure 6: HCV-2 Controlled Area For Operation At 4.2 MeV



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Figure 7: Mobile Eagle Controlled Area



4 Cumulative Impacts

This section of the EA addresses the potential cumulative impacts associated with the implementation of either the Proposed Action or the No Action Alternative outlined in Section 2 and other projects/programs that are planned for the region. The following paragraphs present a general discussion regarding cumulative effects that would be expected.

The Council on Environmental Quality defines cumulative impacts as “the impact on the environment which results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time” (40 CFR Part 1508.7).

As part of a complimentary mix of technologies, CBP currently operates Mobile and Pallet Vehicle and Cargo Inspection System (VACIS®) Gamma Imaging Inspection Systems at the Port of Los Angeles, Port of Long Beach and Carson CES and Radiation Portal Monitors at the Ports of Los Angeles and Long Beach for the NII of cargo containers. The potential impacts of operating these systems were evaluated in the *Environmental Assessment for Gamma Imaging Inspection System Port of Los Angeles, Port of Long Beach, Carson Container Examination Station, Los Angeles County, California, January 2007*; *Environmental Assessment for Radiation Portal Monitor Systems, Port of Los Angeles, Los Angeles County, California, December 2005*; and *Environmental Assessment for Radiation Portal Monitor Systems, Port of Long Beach, Los Angeles County, California, December 2005* and were found to have No Significant Impact. The addition of the High Energy Mobile X-Ray Inspection Systems has not been found to significantly increase the level of air emissions at the Ports. See Appendix B for these calculations. As with these systems, the HCV-2 and Mobile Eagle® and associated controlled areas will be separated from other NII operating areas, adjacent structures, work areas and traffic flows to protect workers, the general public and contents of adjacent buildings. CBP plans to replace two of the Mobile VACIS® at the Ports of Los Angeles and Long Beach and Carson CES with two of the HCV-2’s evaluated in this EA.

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If additional new NII equipment is added to the Ports or CES, it will be separated from adjacent structures, work areas and traffic flows to protect workers, the general public and contents of adjacent buildings. The amount and type of radioactive material used and radiation generated will define the controlled area around each NII site. The controlled areas will not overlap. By controlling access to these controlled areas, CBP will ensure that radiation exposure is kept as low as possible and is not cumulative in its effects.

If CBP determines that future procurements of NII systems are warranted, they will be evaluated in separate "Action Specific" EAs.

In summary, neither the Proposed Action nor the No Action Alternative would be anticipated to result in any significant contribution to past, present and reasonably foreseeable future actions in the local or regional context for any given resource.

Section

5

5 Findings and Conclusions

Findings

The evaluation of the Proposed Action, fielding and operation of four HCV-2's and one Mobile Eagle® at the Ports of Los Angeles and Long Beach and Carson CES, Los Angeles County, California, indicates that the physical and socioeconomic environments at the Ports and CES will not be significantly affected. The predicted consequences on resource areas are briefly described below.

Climate - The Proposed Action will not have an impact on the climate.

Geology and Soils - No construction or excavation is required for the Proposed Action. Seismic hazards related to liquefaction and ground shaking would have minimal impact on the High Energy Mobile X-Ray Inspection systems. Direct impacts to geology and soils would not occur from the implementation of the Proposed Action.

Hydrology and Water Quality - The Proposed Action will not affect hydrology, water resources or water quality.

Floodplain - There are 100 and 500 year floodplains located at the Ports of Los Angeles and Long Beach. The Carson CES is not located in a floodplain. The Proposed Action will not have an impact on these floodplains.

Wetlands - The Proposed Action will occur on previously paved surfaces at the Ports of Los Angeles and Long Beach or at an existing parking lot at the Carson CES. The Proposed Action will not be located in a wetland and will not impact any wetlands.

Coastal Zone - The Port of Los Angeles and Port of Long Beach is located in the California Coastal Zone. The Carson CES is located outside of the California Coastal Zone. No Coastal Zone resources will be adversely affected by the Proposed Action.

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Vegetation and Wildlife –The Proposed Action will occur on previously paved surfaces and will be consistent with current actions at the Ports and CES. No vegetation or wildlife will be impacted by the Proposed Action.

Threatened and Endangered Species – The Proposed Action will not cause any disturbances to critical habitats or impact threatened or endangered species in the course of operation. An area on Pier 400 of the Port of Los Angeles has been established as critical nesting habitat for the California Least Tern (*Sterna antillarum browni*). The nesting area is located outside of the operational area of the Port. Neither the California Least Tern nor any other threatened or endangered species will be impacted by the Proposed Action.

Air Quality – The Ports of Los Angeles and Long Beach and the Carson CES, are located in Los Angeles County, CA. Los Angeles County is located in the Los Angeles South Coast Air Basin, CA. This area is designated as an air quality non-attainment area for Ozone (8-hour), carbon monoxide, PM-10 and PM-2.5. The Proposed Action will not significantly affect air quality. Worst case scenario studies have shown emissions resulting from the Proposed Action to be substantially lower than the state and Federal requirements for this area. Conformity analysis conducted in accordance with 40 CFR 93, Subpart B, shows emissions for these criteria to be *de minimus*. No long-term air quality impacts would occur. Impacts to air quality were found to not be significant.

Noise – The Proposed Action is consistent with current actions at the Ports and CES and will not exceed any of the pre-existing noise conditions nor limit requirements. As a result, the Proposed Action will not have a significant noise impact.

Land Use and Zoning - The Proposed Action is consistent with current actions at the Ports and CES and will not impact land use or zoning.

Aesthetics and Visual Resources - The Proposed Action would not obscure or result in abrupt changes to the complexity of the landscape and skyline when viewed from points readily accessible to the public. No long-term change to the character of the area would occur as a result of the Proposed Action.

Infrastructure / Utilities – The Ports of Los Angeles and Long Beach and Carson CES have pre-existing water and electrical services. The Proposed Action will not impact the infrastructure and utility services of the Ports and CES.

Traffic / Transportation - The Proposed Action will not impact the parking and accessibility to the Port of Los Angeles and Port of Long Beach and will not impact the flow of traffic in and out of the Ports.

Waste Management – Wastes associated with the Proposed Action are lubricants for the operation and maintenance of the HCV-2's and Mobile Eagle®. These lubricants accumulated in approved containers at or near the point of generation and recycled for use again by a licensed waste recycling company. 40 CFR 279 exempts used lubricants from consideration as a hazardous waste if it is managed through a used oil recycler and is not mixed with any other hazardous wastes. The operation and maintenance of the systems would not result in generation rates that would exceed 100 kilograms (220 pounds) of waste in any calendar month (Conditionally Exempt Generator).

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Historical and Archeological (Cultural) Resources – The Proposed Action will be consistent with current actions at the Ports and CES. There will be no impact to historical or archaeological resources from the Proposed Action.

Socioeconomic - The Proposed Action will not alter the population distribution or growth rates or have any short or long-term effects on the socioeconomics of the region.

Environmental Justice - Implementation of the Proposed Action is not expected to have any negative or disproportionate effects on minority and low income populations or children.

Irreversible and Irretrievable Commitment of Resources - Irreversible and irretrievable commitment of resources associated with the Proposed Action will be materials, utilities, labor and time expended to the operation of the HCV-2's and Mobile Eagle®.

Radiological Health and Safety – Radiological impacts associated with the Proposed Action have the potential to impact the health and safety of operators, officers and the general public. As promulgated by the Nuclear Regulatory Commission (NRC) in 10 CFR Part 20, the maximum permissible level of radiation dose to the general public is 100 mrem (100,000 µrem) in a year. Due to the nature of their job, CBP Officers and port employees who work around the systems have the potential to be “occupationally exposed” to radiation. However, CBP has elected to use the general public standard, 100 mrem in a year, as the maximum permissible level of radiation dose for CBP officers and port employees. Based upon CBP’s chosen criterion of 2000 hours in a year as the time of exposure, neither CBP Officers, port employees, nor the general public will experience a cumulative dose greater than 0.05 mrem (50 µrem) in any one hour. The cumulative radiation dose from HCV-2 and Mobile Eagle® will be limited to no more than 0.05 mrem (50 µrem) in any one hour through the establishment of controlled areas. Analysis shows that exposures are expected to be well below NRC prescribed limits; therefore the health and safety impacts from radiological exposure were found to not be significant.

Mitigation

Mitigation actions would be expected to reduce, avoid, or compensate for most adverse effects. Refer to Section 3 for explanation of proposed mitigation measures.

Conclusions

Implementation of the Proposed Action, coupled with the identified mitigation measures, will result in no significant, long term effects on the quality of the natural or human environment. An Environmental Impact Statement is not required and will be prepared. Issuance of a Finding of No Significant Impact is appropriate.

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Section

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California Department of Parks and Recreation, CCR Title 14 Natural Resources, Division 3, Chapter 11.5.

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*ENVIRONMENTAL ASSESSMENT FOR
HIGH-ENERGY MOBILE X-RAY INSPECTION SYSTEMS
PORT OF LOS ANGELES, PORT OF LONG BEACH, AND CARSON
CONTAINER EXAMINATION STATION
LOS ANGELES COUNTY, CALIFORNIA*

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Section

7

7 Persons and Organizations Contacted

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Section

8

8 Acronyms and Abbreviations

A	Ampere
AAQS	Ambient Air Quality Standards
ALARA	As Low As is Reasonably Achievable
BEIR	Biological Effects of Ionizing Radiation
BMP	Best Management Practices
CA	California
CAA	Clean Air Act
CARB	California Air Resources Board
CBP	Customs and Border Protection
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
¹³⁷ Cs	Cesium 137
CSI	Container Security Initiative
CO	Carbon Monoxide
⁶⁰ Co	Cobalt 60
dB	Decibel
dBA	Audio decibel
DOT	Department of Transportation
DHS	Department of Homeland Security
E	Emissions
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
Erg	An erg is a small but measurable amount of energy
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
FR	Federal Register
Gy	Gray
HCV-2	Heimann Cargo Vision-2
HVAC	Heating Ventilation and Air Conditioning

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HDD	Heavy Duty Diesel
HDDV	Heavy Duty Diesel Vehicle
HDGV	Heavy Duty Gas Vehicle
Hz	Hertz
ICRP	International Commission on Radiological Protection
Lb	pounds
LDDT	Light Duty Diesel Truck
LDDV	Light Duty Diesel Vehicle
LDGT	Light Duty Gas Truck
LDGV	Light Duty Gas Vehicle
Ldn	Day-Night average sound level
mrad	millirad
mrem	millirem
MOA	Military Operating Area
MOU	Memorandum of Understanding
MPE	Maximum Permissible Exposure
NAAQS	National Ambient Air Quality Standards
NCRP	National Council on Radiation Protection
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NII	Non-Intrusive Inspection
NOA	Notice of Availability
NOI	Notice of Intent
NOx	Nitrogen Oxides
NRC	Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
O ₃	Ozone
ONDCP	Office of National Drug Control Policy
OSHA	Occupational Safety and Health Administration
PEA	Programmatic Environmental Assessment
PM ₁₀	Particulate Matter 10 micrometers or smaller in diameter
POE	Port of Entry
rad	Radiation Absorbed Dose
μrad	microrad
rem	Roentgen Equivalent Man
μrem	microrem
ROG	Reactive Organic Gases
RSO	Radiation Safety Officer
SAIC	Science Applications International Corporation
SIP	State Implementation Plan
SOx	Sulfur Oxides
SHPO	State Historic Preservation Officer
TEDE	Total Effective Dose Equivalent
TV	Television
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation

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U.S.	United States
U.S.C.	United States Code
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USFWS	United States Fish and Wildlife Service
VAC	Volts, Alternating Current
VACIS®	Vehicle and Cargo Inspection System
VOC	Volatile Organic Compounds

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PORT OF LOS ANGELES, PORT OF LONG BEACH, AND CARSON
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LOS ANGELES COUNTY, CALIFORNIA*

Section

9

9 List of Preparers

Name	Agency/Organization	Discipline/Expertise	Experience	Role in Preparing EA
David Walls	Organizational Strategies, Inc	Environmental Planning/Natural Resources	14 years in NEPA and related studies	Environmental Analysis & Impact Evaluation
Audra Upchurch	Organizational Strategies, Inc	Environmental Analyst	8 years of environmental related experience	Environmental Analysis & Impact Evaluation

Section

10

10 Distribution List

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PORT OF LOS ANGELES, PORT OF LONG BEACH, AND CARSON
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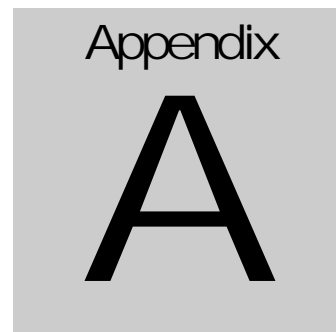
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PORT OF LOS ANGELES, PORT OF LONG BEACH, AND CARSON
CONTAINER EXAMINATION STATION
LOS ANGELES COUNTY, CALIFORNIA*



Appendix A-Correspondence

**ENVIRONMENTAL ASSESSMENT FOR
HIGH-ENERGY MOBILE X-RAY INSPECTION SYSTEMS
PORT OF LOS ANGELES, PORT OF LONG BEACH, AND CARSON
CONTAINER EXAMINATION STATION
LOS ANGELES COUNTY, CALIFORNIA**



ORGANIZATIONAL STRATEGIES, INC.

1331 Pennsylvania Ave, NW Suite 1415
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Phone: (202) 393-8441
Fax: (202) 393-8442
www.orgstrategies.com

February 9, 2007

Charles F. Raysbrook, Regional Manager
California Department of Fish & Game
4949 Viewridge Avenue
San Diego, CA 92123

SUBJECT: Fielding and Operation of High Energy X-Ray Inspection Systems for use by the Ports of Los Angeles and Long Beach, Los Angeles County, California

Dear Mr. Raysbrook:

On behalf of United States Customs and Border Protection (CBP), Organizational Strategies, Inc. is notifying you of the Proposed Action noted above. An Environmental Assessment (EA) is being drafted to evaluate the potential environmental effects of the Proposed Action. As soon as the draft EA is available you will be sent a copy for your immediate review and comment. If you do not wish to have a copy of the draft EA for review, please notify Ms. Audra Upchurch at (202) 393-8441 x232.

The Proposed Action consists of the fielding and operation of two mobile high energy x-ray inspection systems for use by the Ports of Los Angeles and Long Beach, Los Angeles County, California. The purpose of the Proposed Action is to allow for the non-intrusive inspection of shipping containers entering the United States. The systems use a linear accelerator to produce images of the contents of the cargo containers. No x-rays will be produced when the systems are not being operated and no radiation source material is used in the operation of these systems. The systems will be stored at the U.S. Customs and Border Protection Container Examination Station in Carson, California and operated at the Ports as required.

Included are maps of the location sites and pictures of the systems to be installed for use by the Ports of Los Angeles and Long Beach. We are aware of the presence of and critical habitat for the California Least Tern (*Sterna antillarum browni*) at Pier 400 at the Port of Los Angeles. The Least Tern habitat is located outside of the operational boundaries of the Port of Los Angeles and of the high energy x-ray inspection systems. We have determined no threatened or endangered species will be affected by the Proposed Action. We request your concurrence with our determination.

Please provide your response to:
Ms. Audra Upchurch
Organizational Strategies, Inc.
1331 Pennsylvania Avenue NW Suite 1415
Washington, DC 20004

If you have any questions to the above, please feel free to contact Ms. Audra Upchurch at (202) 393-8441 x232 or e-mail aupchurch@orgstrategies.com. Thank you in advance for your assistance.

Sincerely,

David Walls
Program Manager
Organizational Strategies, Incorporated

Enclosures

ENVIRONMENTAL ASSESSMENT FOR
HIGH-ENERGY MOBILE X-RAY INSPECTION SYSTEMS
PORT OF LOS ANGELES, PORT OF LONG BEACH, AND CARSON
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February 9, 2007

Larry Simon
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SUBJECT: Fielding and Operation of High Energy X-Ray Inspection Systems for use by the Ports of
Los Angeles and Long Beach, Los Angeles County, California

Dear Mr. Simon:

On behalf of United States Customs and Border Protection (CBP), Organizational Strategies, Inc. is notifying you of the Proposed Action noted above. An Environmental Assessment (EA) is being drafted to evaluate the potential environmental effects of the Proposed Action. As soon as the draft EA is available you will be sent a copy for your immediate review and comment. If you do not wish to have a copy of the draft EA for review, please notify Ms. Audra Upchurch at (202) 393-8441 x232.

The Proposed Action consists of the fielding and operation of two mobile high energy x-ray inspection systems for use by the Ports of Los Angeles and Long Beach, Los Angeles County, California. The purpose of the Proposed Action is to allow for the non-intrusive inspection of shipping containers entering the United States. The systems use a linear accelerator to produce images of the contents of the cargo containers. No x-rays will be produced when the systems are not being operated and no radiation source material is used in the operation of these systems. The systems will be stored at the U.S. Customs and Border Protection Container Examination Station in Carson, California and operated at the Ports as required.

Included are maps of the location sites and pictures of the systems to be installed for use by the Ports of Los Angeles and Long Beach. Both the Port of Long Beach and Port of Los Angeles are located inside of the California Coastal Zone. The Carson Container Examination Station is located outside of the California Coastal Zone. We have determined the California Coastal Zone will not be adversely affected by the Proposed Action. We request your concurrence with our determination.

Please provide your response to:
Ms. Audra Upchurch
Organizational Strategies, Inc.
1331 Pennsylvania Avenue NW Suite 1415
Washington, DC 20004

If you have any questions to the above, please feel free to contact Ms. Audra Upchurch at (202) 393-8441 x232 or e-mail aupchurch@orgstrategies.com. Thank you in advance for your assistance.

Sincerely,

David Walls
Program Manager
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Enclosures

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PORT OF LOS ANGELES, PORT OF LONG BEACH, AND CARSON
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February 9, 2007

Mr. Milford W. Donaldson, FAIA
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SUBJECT: Fielding and Operation of High Energy X-Ray Inspection Systems for use by the Ports of
Los Angeles and Long Beach, Los Angeles County, California

Dear Mr. Donaldson:

On behalf of United States Customs and Border Protection (CBP), Organizational Strategies, Inc. is notifying you of the Proposed Action noted above. An Environmental Assessment (EA) is being drafted to evaluate the potential environmental effects of the Proposed Action. As soon as the draft EA is available you will be sent a copy for your immediate review and comment. If you do not wish to have a copy of the draft EA for review, please notify Ms. Audra Upchurch at (202) 393-8441 x232.

The Proposed Action consists of the fielding and operation of two mobile high energy x-ray inspection systems for use by the Ports of Los Angeles and Long Beach, Los Angeles County, California. The purpose of the Proposed Action is to allow for the non-intrusive inspection of shipping containers entering the United States. The systems use a linear accelerator to produce images of the contents of the cargo containers. No x-rays will be produced when the systems are not being operated and no radiation source material is used in the operation of these systems. The systems will be stored at the U.S. Customs and Border Protection Container Examination Station in Carson, California and operated at the Ports as required.

included are maps of the location sites and pictures of the systems to be installed for use by the Ports of Los Angeles and Long Beach. No construction or excavation is necessary for the Proposed Action. We have determined that no historic properties will be adversely affected by the Proposed Action. We request your concurrence with our determination.

Please provide your response to:
Ms. Audra Upchurch
Organizational Strategies, Inc.
1331 Pennsylvania Avenue NW Suite 1415
Washington, DC 20004

If you have any questions to the above, please feel free to contact Ms. Audra Upchurch at (202) 393-8441 x232 or e-mail aupchurch@orgstrategies.com. Thank you in advance for your assistance.

Sincerely,

David Walls
Program Manager
Organizational Strategies, Incorporated

Enclosures

ENVIRONMENTAL ASSESSMENT FOR
HIGH-ENERGY MOBILE X-RAY INSPECTION SYSTEMS
PORT OF LOS ANGELES, PORT OF LONG BEACH, AND CARSON
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February 9, 2007

Supervisor
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United States Fish and Wildlife Service
6010 Hidden Valley Road
Carlsbad, California 92011

SUBJECT: Fielding and Operation of High Energy X-Ray Inspection Systems for use by the Ports of Los Angeles and Long Beach, Los Angeles County, California

Dear Sir or Madam:

On behalf of United States Customs and Border Protection (CBP), Organizational Strategies, Inc. is notifying you of the Proposed Action noted above. An Environmental Assessment (EA) is being drafted to evaluate the potential environmental effects of the Proposed Action. As soon as the draft EA is available you will be sent a copy for your immediate review and comment. If you do not wish to have a copy of the draft EA for review, please notify Ms. Audra Upchurch at (202) 393-8441 x232.

The Proposed Action consists of the fielding and operation of two mobile high energy x-ray inspection systems for use by the Ports of Los Angeles and Long Beach, Los Angeles County, California. The purpose of the Proposed Action is to allow for the non-intrusive inspection of shipping containers entering the United States. The systems use a linear accelerator to produce images of the contents of the cargo containers. No x-rays will be produced when the systems are not being operated and no radiation source material is used in the operation of these systems. The systems will be stored at the U.S. Customs and Border Protection Container Examination Station in Carson, California and operated at the Ports as required.

Included are maps of the location sites and pictures of the systems to be installed for use by the Ports of Los Angeles and Long Beach. We are aware of the presence of and critical habitat for the California Least Tern (*Sterna antillarum browni*) at Pier 400 at the Port of Los Angeles. The Least Tern habitat is located outside of the operational boundaries of the Port of Los Angeles and of the high energy x-ray inspection systems. We have determined no threatened or endangered species will be affected by the Proposed Action. We request your concurrence with our determination.

Please provide your response to:
Ms. Audra Upchurch
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Washington, DC 20004

If you have any questions to the above, please feel free to contact Ms. Audra Upchurch at (202) 393-8441 x232 or e-mail aupchurch@orgstrategies.com. Thank you in advance for your assistance.

Sincerely,

David Walls
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Enclosures

**ENVIRONMENTAL ASSESSMENT FOR
HIGH-ENERGY MOBILE X-RAY INSPECTION SYSTEMS
PORT OF LOS ANGELES, PORT OF LONG BEACH, AND CARSON
CONTAINER EXAMINATION STATION
LOS ANGELES COUNTY, CALIFORNIA**

U.S. Department of Homeland Security
Washington, DC 20229



**U.S. Customs and
Border Protection**

March 13, 2007

Mr. Anthony Madrigal, Jr.
Interim-Chairperson
Cahuilla Band of Indians
P.O. Box 391760
Anza, CA 92539

Subject: Fielding and Operation of High Energy Mobile X-Ray Inspection Systems at the Ports
of Los Angeles and Long Beach and Carson Container Examination Station, Los
Angeles County, California

Dear Chairperson Madrigal:

The U.S. Customs and Border Protection (CBP), Office of Information Technology, Laboratories and Scientific Services, Interdiction Technology Branch is notifying you of the Proposed Action noted above. In accordance with Section 106 of the National Historic Preservation Act and its implementing regulations, 36 CFR Part 800, CBP wishes to continue our consultation process with the appropriate federally recognized Native American tribes who historically used this region or continue to use this area. We welcome your comments on this undertaking and look forward to hearing from you regarding known sacred sites or other traditional cultural properties within the proposed project area. CBP is also preparing an Environmental Assessment (EA) for the Proposed Action mentioned above. As soon as the draft EA is available, you will be sent a copy for your immediate review and comment.

The Proposed Action consists of the fielding and operation of five high energy mobile x-ray inspection systems at the Ports of Los Angeles and Long Beach and Carson Container Examination Station, Los Angeles County, California for the purpose of conducting non-intrusive inspections of cargo containers entering the United States. The systems use a linear accelerator to produce images of the contents of the cargo containers. No x-rays will be produced when the systems are not being operated and no radiation source material is used in the operation of the system. No construction is required for the Proposed Action. These mobile systems will operate on previously paved surfaces at the Ports and Container Examination Station and be stored at the Container Examination Station.

Enclosed are maps and aerial pictures that illustrate the locations of these proposed systems. Pictures of the systems themselves are also included for reference.

If you have any questions or responses to the above, please feel free to contact Mr. David Walls at (202) 393-8441 x235 or facsimile (202) 393-8442.

Sincerely,

A handwritten signature in black ink, appearing to read "Sharon Sharp-Harrison".

Sharon Sharp-Harrison
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Interdiction Technology Branch

Enclosures

**ENVIRONMENTAL ASSESSMENT FOR
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PORT OF LOS ANGELES, PORT OF LONG BEACH, AND CARSON
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**U.S. Customs and
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March 13, 2007

Mr. Henry Duro
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San Manuel Band of Mission Indians
26569 Community Center Drive
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Subject: Fielding and Operation of High Energy Mobile X-Ray Inspection Systems at the Ports
of Los Angeles and Long Beach and Carson Container Examination Station, Los
Angeles County, California

Dear Chairperson Duro:

The U.S. Customs and Border Protection (CBP), Office of Information Technology, Laboratories and Scientific Services, Interdiction Technology Branch is notifying you of the Proposed Action noted above. In accordance with Section 106 of the National Historic Preservation Act and its implementing regulations, 36 CFR Part 800, CBP wishes to continue our consultation process with the appropriate federally recognized Native American tribes who historically used this region or continue to use this area. We welcome your comments on this undertaking and look forward to hearing from you regarding known sacred sites or other traditional cultural properties within the proposed project area. CBP is also preparing an Environmental Assessment (EA) for the Proposed Action mentioned above. As soon as the draft EA is available, you will be sent a copy for your immediate review and comment.

The Proposed Action consists of the fielding and operation of five high energy mobile x-ray inspection systems at the Ports of Los Angeles and Long Beach and Carson Container Examination Station, Los Angeles County, California for the purpose of conducting non-intrusive inspections of cargo containers entering the United States. The systems use a linear accelerator to produce images of the contents of the cargo containers. No x-rays will be produced when the systems are not being operated and no radiation source material is used in the operation of the system. No construction is required for the Proposed Action. These mobile systems will operate on previously paved surfaces at the Ports and Container Examination Station and be stored at the Container Examination Station.

Enclosed are maps and aerial pictures that illustrate the locations of these proposed systems. Pictures of the systems themselves are also included for reference.

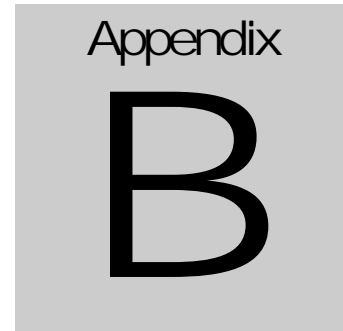
If you have any questions or responses to the above, please feel free to contact Mr. David Walls at (202) 393-8441 x235 or facsimile (202) 393-8442.

Sincerely,

Sharon Sharp-Harrison
Branch Director
Office of Information and Technology
Laboratories and Scientific Services
Interdiction Technology Branch

Enclosures

*ENVIRONMENTAL ASSESSMENT FOR
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Appendix B- Air Quality Analysis

**AIR QUALITY ANALYSIS FOR THE HIGH ENERGY MOBILE X-RAY INSPECTION
SYSTEMS AT PORTS OF LOS ANGELES AND LONG BEACH AND THE CARSON
CONTAINER EXAMINATION STATION, LOS ANGELES COUNTY, CALIFORNIA**

This analysis considers operational impacts to local and regional air quality that could result from implementation of the Proposed Action.

Construction

The High Energy Mobile X-Ray Inspection Systems will be operated on existing paved surfaces at the Port of Los Angeles and Long Beach. The systems will be stored in a preexisting warehouse at the Carson CES. No construction is necessary for the Proposed Action.

Operations

Estimated emissions from the operation of the HCV-2 and Mobile Eagle® at the Port of Los Angeles and Long Beach are well below National and California emission standards (NAAQS and California State AAQS).

The Environmental Protection Agency has determined that for analysis not requiring detailed specific emission estimates tailored to local conditions, the summary of idle emission factors contained in EPA420-F-98-014 can be used to obtain first-order approximations of emissions under idling conditions (e.g., drive-thru lanes). Tables 2 and 3 represent the idling vehicle emissions likely to result from the operation of High Energy Mobile X-Ray Inspection Systems and show the worst-case scenario for each pollutant

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taken over two 6 month, winter and summer, periods and then averaged together. Calculations were made based on the following assumptions:

- 1) High Energy Mobile X-Ray Inspection Systems will be operated during two 8-hour work shifts (16 hours) equaling 320 inspections per day (5,840 hour operational year);
- 2) High Energy Mobile X-Ray Inspection Systems will be continuously idling, or scanning cargo containers at a speed of less than 0.5 miles per hour, during the work shift to provide system power and environmental controls.

CBP plans to replace two of the existing four Mobile VACIS® Gamma Imaging Inspection Systems with two of the HCV-2's evaluated in this EA. Tables 2 and 3 describe the potential emissions of the fielding and operation of the High Energy Mobile X-Ray Inspection Systems. Tables 4 and 5 show the potential emissions from the existing Mobile VACIS®. Table 6 describes the potential cumulative emissions from both the High Energy Mobile X-Ray Inspection Systems and Mobile VACIS®.

High Energy Mobile X-Ray Inspection Systems

The engine type currently used on the Mobile Eagle® at the Ports of Los Angeles and Long Beach is the Mack AI-300A medium duty diesel engine with an average horsepower (HP) rating of 300 HP at 1950 Revolutions Per Minute (RPM). The engine type to be used on the HCV-2's at the Ports of Los Angeles and Long Beach is the International DT570 medium duty diesel engine with an average horsepower (HP) rating of 285 HP at 2200 Revolutions Per Minute (RPM) of 2200. Designated as a clean fuel fleet vehicle/low emissions vehicle, all engine types meet the EPA Tier II requirements for emissions.

Table 2: Potential Worst-Case Idling Emissions of a High Energy Mobile X-Ray Inspection System

VOC		CO		NOx		PM ₁₀		Vehicle Type
Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	HDDV (Heavy Duty Diesel Vehicle)
0.027 (0.43)	0.08	0.207 (3.31)	0.60	0.12 (1.92)	0.35	0.005 (0.08)	0.015	

(USEPA, 1998)

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Table 3: Potential Worst-Case Idling Emissions of Five High Energy Mobile X-Ray Inspection Systems

VOC		CO		NOx		PM ₁₀		Vehicle Type
Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	HDDV (Heavy Duty Diesel Vehicle)
0.14 (2.24)	0.41	1.04 (16.64)	3.04	0.60 (9.6)	1.75	0.025 (0.40)	0.016	

(USEPA, 1998)

Table 4: Potential Worst-Case Idling Emissions of a Mobile Gamma Imaging Inspection System

VOC		CO		NOx		PM ₁₀		Vehicle Type
Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	HDDV (Heavy Duty Diesel Vehicle)
0.027 (0.43)	0.08	0.207 (3.31)	0.6	0.12 (1.92)	0.36	0.005 (0.08)	0.015	

(USEPA, 1998)

Table 5: Potential Worst-Case Idling Emissions of Four Mobile Gamma Imaging Inspection Systems

VOC		CO		NOx		PM ₁₀		Vehicle Type
Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	HDDV (Heavy Duty Diesel Vehicle)
0.108 (1.73)	0.32	0.83 (13.28)	2.42	0.48 (7.68)	1.40	0.02 (0.32)	0.058	

(USEPA, 1998)

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Table 6: Potential Worst-Case Idling Emissions of Five High Energy Mobile X-Ray Inspection Systems and Two Mobile Gamma Imaging Inspection Systems (Cumulative Impact)

VOC		CO		NOx		PM ₁₀		Vehicle Type
Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	HDDV (Heavy Duty Diesel Vehicle)
0.189 (0.302)	0.55	1.45 (23.2)	4.23	0.84 (13.44)	2.45	0.035 (0.56)	0.102	

(USEPA, 1998)

Table 7 compares the data presented in Table 6 with the conformity criteria for non-attainment areas. This comparison shows that the estimated yearly emissions attributable to idling vehicles are well below the allowable limits set in 40 CFR Part 93.153, *Determining Conformity of Federal Actions to State or Federal Implementation Plans* (the rule). The rule applies to those Federal actions that are located in areas of non-attainment of the NAAQS.

Table 7: Conformity Criteria for Nonattainment Areas

Pollutant	Criterion (tons/yr)	Worst Case Idling (tons/yr)
Ozone (VOCs or NOx):		0.55 (VOC); 2.45 (NOx)
- Serious NAAs	50	
- Severe NAAs	25	
- Extreme NAAs	10	
-Other ozone NAAs outside an ozone transport region	100	
-Marginal and moderate NAAs inside an ozone transport region		
CO:		4.23
- All NAAs	100	
SO ₂ or NO ₂ :	100	
- All NAAs		
PM ₁₀ :		0.105
- Moderate NAAs	100	
- Serious NAAs	70	
Pb:	25	
- All NAAs		

(40 CFR Part 93.153)

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Table 8 lists the NAAQS and the California State Ambient Air Quality Standards. The High Energy Mobile X-Ray Inspection System operation is well within the limits of the regulations of emissions standards required by both state and Federal governments.

Table 8: NAAQS and California State Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards	Federal Standards	
		Concentration	Primary	Secondary
Ozone (O ₃)	1 Hour	0.09 ppm (180 µg/m ³)	—	Same as Primary Standard
	8 Hour	0.07 ppm (137 µg/m ³)	0.08 ppm (157 µg/m ³)	
Respirable Particulate Matter (PM ₁₀)	24 Hour	50 µg/m ³	150 µg/m ³	Same as Primary Standard
	Annual Arithmetic Mean	20 µg/m ³	—	
Fine Particulate Matter (PM _{2.5})	24 Hour	No Separate State Standard	35 µg/m ³	Same as Primary Standard
	Annual Arithmetic Mean	12 µg/m ³	15 µg/m ³	
Carbon Monoxide (CO)	8 Hour	9.0 ppm (10 mg/m ³)	9.0 ppm (10 mg/m ³)	None
	1 Hour	20 ppm (23 mg/m ³)	35 ppm (40 mg/m ³)	
	8 Hour (Lake Tahoe)	6 ppm (7 mg/m ³)	—	—
Nitrogen Dioxide (NO ₂)	Annual Arithmetic Mean	—	0.053 ppm (100µg/m ³)	Same as Primary Standard
	1 Hour	0.25 ppm (470 µg/m ³)	—	
Sulfur Dioxide (SO ₂)	Annual Arithmetic Mean	—	0.030 ppm (80µg/m ³)	—
	24 Hour	0.04 ppm (105µg/m ³)	0.14 ppm (365µg/m ³)	—
	3 Hour	—	—	0.5 ppm (1300µg/m ³)
	1 Hour	0.25 ppm (655µg/m ³)	—	—
Lead	30 Day Average	1.5 µg/m ³	—	—
	Calendar Quarter	—	1.5 µg/m ³	Same as Primary Standard
Visibility Reducing Particles	8 Hour	Extinction coefficient of 0.23 per kilometer – visibility of ten miles or more (0.07 – 30 miles or more for Lake Tahoe) due to particles when relative humidity is less than 70 percent.	NO FEDERAL STANDARDS	
Sulfates	24 Hour	25 µg/m ³		
Hydrogen Sulfide	1 Hour	0.03 ppm (42µg/m ³)		
Vinyl Chloride	24 Hour	0.01 ppm (26 µg/m ³)		

(CARB, 2006)

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Additional Emissions Estimates

Additional emissions estimates were recently conducted by West Virginia University's Center for Alternative Fuels, Engines, and Emissions (CAFFE) on Model Year 1991-2004 Heavy-Duty Diesel Vehicles. The emission estimates using CAFFE emissions estimates are provided for comparison.

Tables 9 and 10 describe the potential emissions of the fielding and operation of the High Energy Mobile X-Ray Inspection Systems. Tables 11 and 12 show the potential emissions from the existing Mobile VACIS®. Table 13 describes the potential cumulative emissions from both the High Energy Mobile X-Ray Inspection Systems and Mobile VACIS®. Table 14 compares the EPA and CAFFE calculations for the cumulative impact of 5 High Energy Mobile X-Ray Inspection Systems and 2 Mobile VACIS®.

Table 9: Potential Worst-Case Idling Emissions of a High Energy Mobile X-Ray Inspection System

VOC		CO		NOx		PM ₁₀		Vehicle Type
Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	HDDV (Heavy Duty Diesel Vehicle)
0.021 (0.34)	0.06	0.05 (0.08)	0.14	0.18 (2.88)	0.53	0.003 (0.05)	0.009	

(CAFFE, 2007)

Table 10: Potential Worst-Case Idling Emissions of Five High Energy Mobile X-Ray Inspection Systems

VOC		CO		NOx		PM ₁₀		Vehicle Type
Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	HDDV (Heavy Duty Diesel Vehicle)
0.11 (1.76)	0.32	0.25 (4.00)	0.73	0.09 (14.4)	2.63	0.015 (0.24)	0.044	

(CAFFE, 2007)

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Table 11: Potential Worst-Case Idling Emissions of a Mobile Gamma Imaging Inspection System

VOC		CO		NOx		PM ₁₀		Vehicle Type
Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	HDDV (Heavy Duty Diesel Vehicle)
0.021 (0.34)	0.06	0.05 (0.08)	0.14	0.18 (2.88)	0.53	0.003 (0.05)	0.009	

(CAFFE, 2007)

Table 12: Potential Worst-Case Idling Emissions of Four Mobile Gamma Imaging Inspection Systems

VOC		CO		NOx		PM ₁₀		Vehicle Type
Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	HDDV (Heavy Duty Diesel Vehicle)
0.84 (13.44)	2.45	0.20 (3.20)	0.58	0.72 (11.52)	2.10	0.012 (0.19)	0.035	

(CAFFE, 2007)

Table 13: Potential Worst-Case Idling Emissions of Five High Energy Mobile X-Ray Inspection Systems and Two Mobile Gamma Imaging Inspection Systems (Cumulative Impact)

VOC		CO		NOx		PM ₁₀		Vehicle Type
Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	Lb/hr (Lb/day)	tons/yr	HDDV (Heavy Duty Diesel Vehicle)
0.147 (2.35)	0.43	0.35 (5.60)	1.02	1.26 (20.16)	3.68	0.021 (0.34)	0.06	

(CAFFE, 2007)

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Table 14: Potential Worst-Case Idling Emissions of Five High Energy Mobile X-Ray Inspection Systems and Two Mobile Gamma Imaging Inspection Systems (Cumulative Impact)

Pollutant	EPA Calculations (tons/yr)	CAFFE Calculations (tons/yr)
VOC	0.57	0.43
CO	4.23	1.02
NOx	2.45	3.68
PM10	0.102	0.06

(EPA, 1998; CAFFE, 2007)

Conclusion

The Ports of Los Angeles and Long Beach and the Carson CES are located in Los Angeles County, CA. Los Angeles County is located in the Los Angeles South Coast Air Basin. This area is classified severe 17 for 8-hour ozone; serious non-attainment for carbon monoxide, and serious non-attainment for PM₁₀ and non-attainment for PM_{2.5} of the Federal Clean Air Act (CAA).

All emission levels from the activities associated with the Proposed Action are below the tons/year *de minimus* threshold for the criteria pollutants as specified in 40 CFR 93.153(b)(1)-(2). Further procedural requirements under the General Conformity Rule are therefore not applicable and the Proposed Action is anticipated to have a less than significant impact on local or regional air quality.

This analysis considers both emission specific to the Proposed Action and cumulative effects of fielding and operation of both Mobile VACIS[®], HCV-2 and Mobile Eagle[®].

Appendix C- Background Information on Ionizing Radiation

The background material contained in this appendix is an excerpt of information found in National Council on Radiation Protection and Measures (NCRP) *Uncertainties in Fatal Cancer Risk Estimates Used in Radiation Protection*, NCRP Report Number 126, and is intended to provide the user with the best available background and regulatory information on ionizing radiation.

Measurement of Radiation Dose

Radiation is measured using units that people seldom encounter. It is important to relate the amount of radiation received by the body to its physiological effects. Two terms used to relate the amount of radiation received by the body are "absorbed dose" and "dose equivalent".

Absorbed dose means the energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the gray (Gy).

The term "rad" (radiation absorbed dose) is the special unit of absorbed dose of 100 ergs per gram. Different materials that receive the same exposure may not absorb the same amount of energy. The rad is the basic unit of the absorbed dose of radiation (i.e., alpha, beta, gamma, and neutron) to the energy they impart in materials. The dose of one rad indicates the absorption of 100 ergs (an erg is a small but measurable amount of energy) per gram of absorbing material. To indicate the dose an individual receives in the unit rad, the word "rad" follows immediately after the magnitude, for example "50 rad". One thousandth of a rad (millirad) is abbreviated "mrad", and one millionth of a rad (microrad) is abbreviated "μrad".

Dose equivalent (H_T) means the product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose

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equivalent are the rem and sievert (Sv). At the present time, rem is used in the U.S. while sieverts are used internationally. Eventually, the U.S. will adopt these international terms.

The term "rem" (Roentgen equivalent man) is a special unit used for expressing dose equivalent. Some types of radiation produce greater biological effects for the same amount of energy imparted than other types. The rem is a unit that relates the dose of absorbed radiation to the biological effect of that dose. Therefore, to relate the absorbed dose of specific types of radiation, a "quality factor" must be multiplied by the dose in rad. To indicate the dose an individual receives in the unit rem, the word "rem" follows immediately after the magnitude, for example "50 rem". One thousandth of a rem (millirem) is abbreviated "mrem", and one millionth of a rem (microrem) is abbreviated "µrem". The quality factor allows for the effect of higher energy deposition along particle tracks produced by various radiation types such as neutrons or alpha particles. For the x-rays such as those currently utilized in the High Energy Mobile X-Ray Inspection Systems the quality factor is 1, meaning that 1 rad of absorbed dose results in 1 rem of dose equivalent.

Regulations Covering Radiation Dose

Regulations pertaining to radiation exposure are administered by many different Federal and state agencies under a variety of legislative authorities.

- **Nuclear Regulatory Commission (NRC) (10 CFR Part 20)**

The Nuclear Regulatory Commission (NRC) promulgates regulations and establishes standards for protection against radiation arising out of activities conducted under licenses issued by the Commission. NRC regulations control the receipt, possession, use, transfer, and disposal of licensed material by any licensee. CBP currently holds an NRC Materials License for ^{137}Cs / ^{60}Co sealed sources.

- **Occupational Safety and Health Administration (OSHA) (29 CFR 1910.1096)**

OSHA regulations establish standards for protection against ionizing radiation that result in an occupational risk, but do not affect the safety of licensed radioactive materials.

- **Environmental Protection Agency (EPA) (Radiation Protection Guidance to Federal Agencies for Occupational Exposure FR 52 2822 January 27, 1987)**

Federal radiation exposure protection guidance for occupational exposure is defined in *Radiation Protection Guidance to Federal Agencies for Occupational Exposure*. Administered by the EPA, the guidance was developed cooperatively by the Nuclear Regulatory Commission, the Occupational Safety and Health Administration, the Mine Safety and

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Health Administration, the Department of Defense, the Department of Energy, the National Aviation and Space Administration, the Department of Commerce, the Department of Transportation, the Department of Health and Human Services and the Environmental Protection Agency. The guidance provides general principles, and specifies the numerical primary guides for limiting worker exposure. It applies to all workers who are exposed to radiation in the course of their work, either as employees of institutions and companies subject to Federal regulation or as Federal employees. It is expected that individual Federal agencies, on the basis of their knowledge of specific worker exposure situations, will use the guidance as the basis upon which to revise or develop detailed standards and regulations to the extent that they have regulatory or administrative jurisdiction.

- **State Regulations**

States are completely free to set their own standards for radiation protection. However, since the NRC sets radiation control standards for reactor-related matters, states generally apply similar criteria and methods to other radiation safety issues. Many states have adopted regulations modeled on the *Suggested State Regulations for Control of Radiation*.

- **State of California (17 California Code of Regulations §30100, et Seq.)**

The California Department of Health Services regulates ionizing and non-ionizing sources of radiation to the extent authorized by the NRC. The California Radiation Control Law [Health Safety Code §§ 25800, et seq.] and the regulations of the Department [17 CCR § 30100, et seq.] govern the regulatory program for any person who is licensed to receive or process radioactive materials, as defined, and not exempted. County health departments are authorized to participate in the regulatory process in their jurisdiction based on a memorandum of understanding with the department. The regulatory program includes the licensing requirement, payment of fees, inspections, employee exposure controls and monitoring, and facility and administrative requirements.

Regulatory Jurisdiction

As it applies to the operation of the High Energy Mobile X-Ray Inspection Systems at Ports of Los Angeles and Long Beach and Carson CES, FDA [21 CFR 1000 *Radiological Health*] and OSHA [29 CFR 1910.1096 *Ionizing Radiation*] are the only agencies with the statutory authority to regulate the operation of radiation producing machines].

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- The NRC Guidance provided in 10 CFR Part 20 Standards for Protection Against Radiation apply to persons licensed by the Commission to receive, possess, use, transfer, or dispose of byproduct, source, or special nuclear material or to operate a production or utilization facility. The High Energy Mobile X-Ray Inspection Systems do not require source or byproduct material for its operation therefore the tenants of this regulation do not constitute regulatory authority over the operation of this equipment.
- The EPA guidance provided in FR 52 2822 *Radiation Protection Guidance to Federal Agencies for Occupational Exposure* is to be used as the basis upon which individual Federal agencies revise or develop detailed standards and regulations and does not constitute statutory authority to regulate the operation of radiation producing machines.
- Title 17 California Code of Regulations § 30100 "General Definitions" defines a "Person" subject to the provisions of the regulations as:
"any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, agency, political subdivision of this State, any other state or political subdivision or agency thereof, and any legal successor, representative, agent, or agency of the foregoing, other than the United States Nuclear Regulatory Commission, the United States Department of Energy, or any successor thereto, and other than Federal Government agencies licensed by the United States Nuclear Regulatory Commission, under prime contract to the United States Department of Energy, or any successor thereto".

Therefore the provisions of 17 CCR §30100 et seq. do not apply to sources of radiation in the possession of CBP.

Dose Limits

Dose limits represent the upper bound limit below which risks from radiation exposure are deemed to be acceptable. Various federal and state regulations establish dose limits for occupational exposures that occur as a result of a person's employment, and limits for the total exposures received by the public in general.

In 10 CFR Part 20 and 17 CCR §30253, the NRC and the State of California identify two classifications of radiation dose to people.

The first classification, "occupational dose", is the dose received by an individual in a restricted area or in the course of employment in which the individual's assigned duties involves exposure to radiation and to radioactive material from licensed and unlicensed sources of radiation, whether in the possession of the licensee or other person. It does not include the dose received from background radiation, as a patient from medical practices, from voluntary participation in medical research programs, or as a member of the general public. The individuals subject to the occupational dose classification must closely monitor their degree of radiation exposure using dosimeters. The annual occupational dose limit for

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adults shall not exceed a total effective dose equivalent of 5 rem (5,000 mrem, 5,000,000 μ rem).

The second radiation dose classification, "public dose", is the dose received by a member of the public from exposure to radiation and to radioactive material released by a licensee, or to another source of radiation either within a licensee's controlled area or in unrestricted areas. It does not include occupational dose or doses received from background radiation, as a patient from medical practices, or from voluntary participation in medical research programs. The total effective dose equivalent to individual members of the general public from the licensed operations shall not exceed 0.1 rem (100 mrem, 100,000 μ rem) in a year. A summary of pertinent dose limits is presented in Table 15.

Table 15: Summary of Regulatory Dose Limits

Dose Limit by Agency and Regulation (mrem in a year)				
	NRC 10 CFR 20	EPA 52 FR 2822	California 17 CCR § 30253	OSHA 29 CFR 1910.1096
"Occupational Dose" = "Radiation Workers" in "Restricted Areas"				
Whole Body	5,000	5,000	5,000	5,000 (1,250 mrem/calendar quarter)
Lens of Eye	15,000	15,000	15,000	5,000 (1,250 mrem/calendar quarter)
Skin, Hands and Feet	50,000	50,000	50,000	
Skin of Whole Body				30,000 (7,500 mrem/calendar quarter)
Hands and forearms; feet and ankles				75,000 (18,750 mrem/calendar quarter)
Minors	10% of above limits	10% of above limits	10% of above limits	10% of above limits
Pregnant Women*	10% of above limits	10% of above limits	10% of above limits	Not Addressed
"Non-Occupational Dose" = "Controlled Area"				
Member of the General Public	100 mrem in a year	Not Addressed	100 mrem in a year	Not Addressed
Radiation Levels in Unrestricted (Uncontrolled) Areas				
Member of the General Public	2 mrem in any one hour		2 mrem in any one hour	Not Addressed

*Applicable period is nine months, or during the entire length of the pregnancy, rather than 1 year.

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Radiation Protection Principles

In the United States and most other countries, three basic principles have governed radiation protection of workers and members of the general public:

1. Any activity involving occupational exposure should be useful enough to society to warrant the exposure of the worker. This same principle applies to virtually any human endeavor that involves some risk of injury.
2. For justified activities, exposure of the work force should be as low as reasonably achievable (ALARA).
3. To provide an upper limit on risk to individual workers, "limitation" of the maximum allowed dose is required. This is required above the protection provided by the first two principles because their primary objective is to minimize the total harm from occupational exposure to the entire work force; they do not limit the way that harm is distributed among individual workers.

As Low as is Reasonably Achievable (ALARA)

"As Low as is Reasonably Achievable" (ALARA) means making every reasonable effort to maintain exposures to ionizing radiation as far below the dose limits as practical, consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest. This common sense approach means that radiation doses for both workers and the general public are typically kept lower than their regulatory limits.

The principle reduction of exposure to levels that are "as low as is reasonably achievable" is typically implemented in four different ways.

1. Shielding of the source holder.
2. Selection of as small of an amount of source material as is needed.
3. Designing facilities to reduce the anticipated exposure.
4. Designing work practices to reduce the anticipated exposure.

Effective implementation of the ALARA principle involves most facets of an effective radiation protection program: education of workers concerning the health risks of exposure to radiation; training in regulatory requirements and procedures to control exposure; monitoring, assessment and reporting of exposure levels and doses; management and supervision of radiation protection activities (including the choice and implementation of radiation control measures).

A comprehensive radiation protection program will also include, as appropriate: properly trained and qualified radiation protection personnel; adequately designed, operated and maintained facilities and equipment; and quality assurance and audit procedures.

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Customs and Border Protection Dose Limits

In conformance with ALARA principles, CBP has adopted of its workers the same dose limit as the NRC and the State of California prescribe for the general public – i.e. 0.1 rem (100 mrem, 100,000 μ rem) in a year. As a result, CBP establishes a controlled area around the High Energy Mobile X-Ray Inspection Systems as described in the Section 3.3.3.3 (Human Exposure) to equally protect the general public and CBP personnel from radiation emissions in accordance with the maximum dose permitted under 17 California Code of Regulations §30100, et Seq.. CBP has taken care to model and explore potential exposure to employees working around these systems, and has even made measurements if someone were to be scanned by this or other NII systems. See "Radiation Dose Equivalent to Stowaways in Vehicles", Khan, et al, Health Physics Journal, Volume 86, No. 5, p. 483, May 2004. All gamma modalities used by CBP required more than 20,000 separate exposure events in a year to reach the public exposure limit. (See Human Exposure Section)

Health Risks

In their August 2004 revised position statement on radiation risk, the Health Physics Society recommended against the quantitative estimation of health risks below an individual dose of 5 rem (5,000 mrem, 5,000,000 μ rem) in a year or a lifetime dose of 10 rem (10,000 mrem, 10,000,000 μ rem) above that received from natural sources. Doses from natural background radiation in the United States average about 0.360 rem (360 mrem, 360,000 μ rem) per year. Estimation of health risks associated with radiation doses that are of similar magnitude as those received from natural sources should be strictly qualitative and encompass a range of hypothetical health outcomes, including the possibility of no adverse health effects at such low levels.

While there is substantial and convincing scientific evidence for health risks following high-dose exposures, below 5-10 rem (which includes occupational and environmental exposures), risks of health effects are either too small to be observed or nonexistent.

The Society has concluded that estimates of risk should be limited to individuals receiving a dose of 5 rem in any one year or a lifetime dose of 10 rem in addition to natural background. Below these doses, risk estimates should not be used. Expressions of risk should only be qualitative, that is, a range based on the uncertainties in estimating risk (NCRP, 1997) emphasizing the inability to detect any increased health detriment (that is zero health effects is a probable outcome).



Appendix D- Background Information Concerning Risks from Occupational Radiation Exposure

The background material contained in this appendix is an excerpt of information found in U.S. Nuclear Regulatory Commission Regulatory Guide 8.29 *Instruction Concerning Risks From Occupational Radiation Exposure*, February 1996 and is intended to provide the user with the best available information about the health risks from occupational exposure to ionizing radiation. Ionizing radiation consists of energy or small particles, such as gamma rays and beta and alpha particles, emitted from radioactive materials, which can cause chemical or physical damage when they deposit energy in living tissue. A question and answer format is used. Many of the questions or subjects were developed by the NRC staff in consultation with workers, union representatives and licensee representatives experienced in radiation protection training.

How Is Radiation Measured?

In the United States, radiation dose or exposure is measured in units called rad, rem, or roentgen(R). For practical purposes with gamma and x-rays, these are considered equal: 1 R = 1 rad = 1 rem.

Milli (m) means 1/1000. For example, 1,000 mrad = 1 rad. Micro (μ) means 1/1,000,000. So, 1,000,000 μ rad = 1 rad, or 10 μ R = 0.000010 R.

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The International System of Units (SI system) for radiation measurement use "gray" and "sievert".

1 Gy = 100 rad

1 mGy = 100 mrad

1 Sv = 100 rem

1 mSv = 100 mrem

Is It Safe To Be Around Sources Of Radiation?

High-level radiation exposure (i.e., greater than 10,000 mrem acute) may have potential health risks. From follow-up of the atomic bomb survivors, we know acutely delivered very high radiation doses can increase the occurrence of certain kinds of disease (e.g., cancer) and negative genetic effects. To protect the public, radiation workers and environment from the potential effects of low-level exposure (i.e., less than 10,000 mrem), the current radiation safety practice is to prudently assume similar adverse effects are possible with low-level protracted exposure to radiation. Thus, the risks associated with low-level medical, occupational and environmental radiation exposure are conservatively calculated to be proportional to those observed with high-level exposure. These calculated risks are compared to other known occupational and environmental hazards, and appropriate safety standards have been established by international and national radiation protection organizations (e.g., ICRP and NCRP) to control and limit potential harmful radiation effects.

Total Body Radiation Exposure Limits

<i>Limit</i>	<i>Amount of Exposure in a Year</i>
Occupational dose limit	5000 mrem
Public dose limit	100 mrem

Both public and occupational dose limits are set to limit cancer risk. It is important to remember when dealing with radiation sources in other materials or waste that there may be chemical or biological hazards separate and distinct from the radiation hazard. These chemical or biological hazards are often more dangerous to humans than the radiation hazard.

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What Is Meant By Health Risk?

A health risk is generally thought of as something that may endanger health. Scientists consider health risk to be the statistical probability or mathematical chance that personal injury, illness, or death may result from some action. Most people do not think about health risks in terms of mathematics. Instead, most of us consider the health risk of a particular action in terms of whether we believe that particular action will, or will not, cause us some harm. The intent of this appendix is to provide estimates of, and explain the basis for, the risk of injury, illness, or death from occupational radiation exposure. Risk can be quantified in terms of the probability of a health effect per unit of dose received.

When x-rays, gamma rays, and ionizing particles interact with living materials such as our bodies, they may deposit enough energy to cause biological damage.

Radiation can cause several different types of events such as the very small physical displacement of molecules, changing a molecule to a different form, or ionization, which is the removal of electrons from atoms and molecules. When the quantity of radiation energy deposited in living tissue is high enough, biological damage can occur as a result of chemical bonds being broken and cells being damaged or killed. These effects can result in observable clinical symptoms.

The basic unit for measuring absorbed radiation is the rad. One rad (0.01 gray in the International System of units) equals the absorption of 100 ergs (a small but measurable amount of energy) in a gram of material such as tissue exposed to radiation. To reflect biological risk, rads must be converted to rems. The new international unit is the sievert (100 rem = 1 Sv). This conversion accounts for the differences in the effectiveness of different types of radiation in causing damage. The rem is used to estimate biological risk. For beta and gamma radiation, a rem is considered equal to a rad.

What Are The Possible Health Effects Of Exposure To Radiation?

Health effects from exposure to radiation range from no effect at all to death, including diseases such as leukemia or bone, breast and lung cancer. Very high (100s of rads), short-term doses of radiation have been known to cause prompt (or early) effects, such as vomiting and diarrhea, skin burns, cataracts and even death. It is suspected that radiation exposure may be linked to the potential for genetic effects in the children of exposed parents. Also, children who were exposed to high doses (20 or more rads) of radiation prior to birth (as an embryo/fetus) have shown an increased risk of mental retardation and other congenital malformations. These effects (with the exception of genetic effects) have been observed in various studies of medical radiologists, uranium miners, radium workers, radiotherapy patients and the people exposed to radiation from atomic bombs dropped on Japan. In addition, radiation effects studies with laboratory animals, in which the animals

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were given relatively high doses, have provided extensive data on radiation-induced health effects, including genetic effects.

It is important to note that these kinds of health effects result from high doses, compared to occupational levels, delivered over a relatively short period of time.

Although studies have not shown a consistent cause-and-effect relationship between current levels of occupational radiation exposure and biological effects, it is prudent from a worker protection perspective to assume that some effects may occur.

Who Developed Radiation Risk Estimates?

Radiation risk estimates were developed by several national and international scientific organizations over the last 40 years. These organizations include the National Academy of Sciences (which has issued several reports from the Committee on the Biological Effects of Ionizing Radiations, BEIR), the National Council on Radiation Protection and Measurements (NCRP), the International Commission on Radiological Protection (ICRP), and the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). Each of these organizations continues to review new research findings on radiation health risks.

Several reports from these organizations present new findings on radiation risks based upon revised estimates of radiation dose to survivors of the atomic bombing at Hiroshima and Nagasaki. For example, UNSCEAR published risk estimates in 1988 and 1993 (UNSCEAR, 1988; UNSCEAR, 1993). The NCRP also published a report in 1988, "New Dosimetry at Hiroshima and Nagasaki and Its Implications for Risk Estimates" (NCRP, 1988). In January 1990, the National Academy of Sciences released the fifth report of the BEIR Committee, "Health Effects of Exposure to Low Levels of Ionizing Radiation", National Research Council, 1990). Each of these publications also provides extensive bibliographies on other published studies concerning radiation health effects for those who may wish to read further on this subject.

What Are The Estimates Of The Risk Of Fatal Cancer From Radiation Exposure?

We don't know exactly what the chances are of getting cancer from a low-level radiation dose, primarily because the few effects that may occur cannot be distinguished from normally occurring cancers. However, we can make estimates based on extrapolation from extensive knowledge from scientific research on high dose effects. The estimates of radiation effects at high doses are better known than are those of most chemical carcinogens (NCRP, 1989).

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From currently available data, the NRC has adopted a risk value for an occupational dose of 1 rem (0.01 Sv) Total Effective Dose Equivalent (TEDE) of 4 in 10,000 of developing a fatal cancer, or approximately 1 chance in 2,500 of fatal cancer per rem of TEDE received. The uncertainty associated with this risk estimate does not rule out the possibility of higher risk, or the possibility that the risk may even be zero at low occupational doses and dose rates.

The radiation risk incurred by a worker depends on the amount of dose received. A worker who receives 5 rems (0.05 Sv) in a year incurs 10 times as much risk as another worker who receives only 0.5 rem (0.005 Sv). Only a very few workers receive doses near 5 rems (0.05 Sv) per year (Raddatz and Hagemeyer, 1995).

According to the BEIR V report (National Research Council, 1990), approximately one in five adults normally will die from cancer from all possible causes such as smoking, food, alcohol, drugs, air pollutants, natural background radiation and inherited traits. Thus, in any group of 10,000 workers, we can estimate that about 2,000 (20%) will die from cancer without any occupational radiation exposure.

To explain the significance of these estimates, we will use as an example a group of 10,000 people, each exposed to 1 rem (0.01 Sv) of ionizing radiation. Using the risk factor of 4 effects per 10,000 rem of dose, we estimate that 4 of the 10,000 people might die from delayed cancer because of that 1 rem dose (although the actual number could be more or less than 4) in addition to the 2,000 normal cancer fatalities expected to occur in that group from all other causes. This means that a 1 rem (0.01 Sv) dose may increase an individual worker's chances of dying from cancer from 20 percent to 20.04 percent. If one's lifetime occupational dose is 10 rem, we could raise the estimate to 20.4 percent. A lifetime dose of 100 rem may increase chances of dying from cancer from 20 to 24 percent. Given the CBP standard of 0.1 rem (0.001 Sv) exposure in any one year, the risk would equate to 4 effects per 100,000. This means that a 0.1 rem (0.001 Sv) dose may increase an individual workers chance of dying from cancer from 20 percent to 20.005 percent. The average measurable dose for radiation workers reported to the NRC was 0.31 rem (0.0031 Sv) for 1993 (Raddatz and Hagemeyer, 1995). Today, very few CBP employees ever accumulate 100 rem (1 Sv) in a working lifetime, and the average career dose of workers at NRC-licensed facilities is 1.5 rem (0.015 Sv), which represents an estimated increase from 20 to about 20.06 percent in the risk of dying from cancer.

It is important to understand the probability factors here. A similar question would be, "If you select one card from a full deck of cards, will you get the ace of spades?" This question cannot be answered with a simple yes or no. The best answer is that your chance is 1 in 52. However, if 1000 people each select one card from full decks; we can predict that about 20 of them will get an ace of spades. Each person will have 1 chance in 52 of drawing the ace of spades, but there is no way we can predict which persons will get that

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card. The issue is further complicated by the fact that in a drawing by 1000 people, we might get only 15 successes, and in another, perhaps 25 correct cards in 1000 draws. We can say that if you receive a radiation dose, you will have increased your chances of eventually developing cancer. It is assumed that the more radiation exposure you get, the more you increase your chances of cancer.

The normal chance of dying from cancer is about one in five for persons who have not received any occupational radiation dose. The additional chance of developing fatal cancer from an occupational exposure of 1 rem (0.01 Sv) is about the same as the chance of drawing any ace from a full deck of cards three times in a row. The additional chance of dying from cancer from an occupational exposure of 10 rem (0.1 Sv) is about equal to your chance of drawing two aces successively on the first two draws from a full deck of cards.

It is important to realize that these risk numbers are only estimates based on data for people and research animals exposed to high levels of radiation in short periods of time. There is still uncertainty with regard to estimates of radiation risk from low levels of exposure. Many difficulties are involved in designing research studies that can accurately measure the projected small increases in cancer cases that might be caused by low exposures to radiation as compared to the normal rate of cancer.

These estimates are considered by the NRC staff to be the best available for the worker to use to make an informed decision concerning acceptance of the risks associated with exposure to radiation. A worker who decides to accept this risk should try to keep exposure to radiation as low as is reasonably achievable (ALARA) to avoid unnecessary risk.

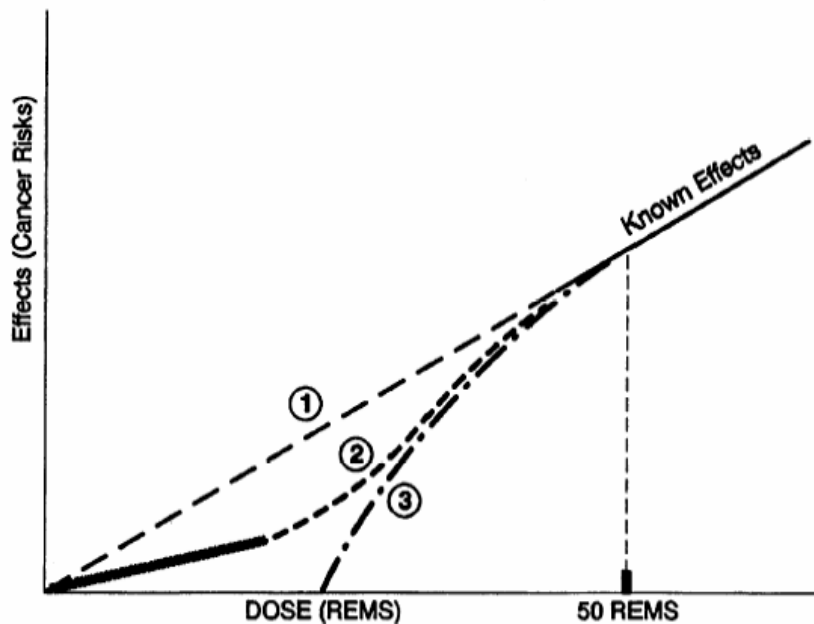
If I Receive A Radiation Dose That Is Within Occupational Limits, Will It Cause Me To Get Cancer?

Probably not. Based on the risk estimates previously discussed, the risk of cancer from doses below the occupational limits is believed to be small. Assessment of the cancer risks that may be associated with low doses of radiation are projected from data available at doses larger than 10 rems (0.1 Sv) (ICRP, 1991). For radiation protection purposes, these estimates are made using the straight line portion of the linear quadratic model (Curve 2 in Figure 8). We have data on cancer probabilities only for high doses, as shown by the solid line in 8. Only in studies involving radiation doses above occupational limits are there dependable determinations of the risk of cancer, primarily because below the limits the effect is small compared to differences in the normal cancer incidence from year to year and place to place. The ICRP, NCRP and other standards-setting organizations assume for radiation protection purposes that there is some risk, no matter how small the dose (Curves 1 and 2). Some scientists believe that the risk drops off to zero at some low dose (Curve 3), the threshold effect, The ICRP and NCRP endorse the linear quadratic model as a conservative means of assuring safety (Curve 2).

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For regulatory purposes, the NRC uses the straight line portion of Curve 2, which shows the number of effects decreasing linearly as the dose decreases. Because the scientific evidence does not conclusively demonstrate whether there is or is not an effect at low doses, the NRC assumes for radiation protection purposes, that even small doses have some chance of causing cancer. Thus, a principle of radiation protection is to do more than merely meet the allowed regulatory limits; doses should be kept as low as is reasonably achievable (ALARA). This is as true for natural carcinogens such as sunlight and natural radiation as it is for those that are manmade, such as cigarette smoke, smog and x-rays.

Figure 8: Some Proposed Models for How the Effects of Radiation Vary with Doses at Low Levels



How Can We Compare The Risk Of Cancer From Radiation To Other Kinds Of Health Risks?

One way to make these comparisons is to compare the average number of days of life expectancy lost because of the effects associated with each particular health risk. Estimates are calculated by looking at a large number of persons, recording the age when death occurs from specific causes, and estimating the average number of days of life lost as a result of these early deaths. The total number of days of life lost is then averaged over the total observed group.

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Several studies have compared the average days of life lost from exposure to radiation with the number of days lost as a result of being exposed to other health risks. The word "average" is important because an individual who gets cancer loses about 15 years of life expectancy, while his or her coworkers do not suffer any loss. Some representative numbers are presented in Table 16. For categories of NRC-regulated industries with larger doses, the average measurable occupational dose in 1993 was 0.31 rem (0.0031 Sv). A simple calculation based on the article by Cohen and Lee (Cohen and Lee, 1991) shows that 0.3 rem (0.003 Sv) per year from age 18 to 65 results in an average loss of 15 days. These estimates indicate that the health risks from occupational radiation exposure are smaller than the risks associated with many other events or activities we encounter and accept in normal day-to-day activities.

It is also useful to compare the estimated average number of days of life lost from occupational exposure to radiation with the number of days lost as a result of working in several types of industries. Table 17 shows average days of life expectancy lost as a result of fatal work-related accidents. Table 17 does not include non-accidental types of occupational risks such as occupational disease and stress because the data are not available.

These comparisons are not ideal because we are comparing the possible effects of chronic exposure to radiation to different kinds of risks such as accidental death, in which death is inevitable if the event occurs. This is the best we can do because good data are not available on chronic exposure to other workplace carcinogens. Also, the estimates of loss of life expectancy for workers from radiation-induced cancer do not take into consideration the competing effect on the life expectancy of the workers from industrial accidents.

Table 16: Estimated Loss of Life Expectancy from Health Risks^a

<i>Health Risks (Average)</i>	<i>Estimate of Life Expectancy Lost</i>
Smoking 20 cigarette a day	6 years
Overweight (by 15%)	2 years
Alcohol consumption (U.S. average)	1 year
All accidents combined	1 year
Motor vehicle accidents	207 days
Home accidents	74 days
Drowning	24 days
All natural hazards (earthquake, lightning, flood, etc.)	7 days
Medical radiation	6 days
Occupational Exposure	
0.3 rem/y from age 18 to 65	15 days

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1 rem/y from age 18 to 65	51 days
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^a Adapted from Cohen and Lee, 1991

Table 17: Estimated Loss of Life Expectancy from Industrial Accidents^a

<i>Industry Type</i>	<i>Estimated Days of Life Expectancy Lost (Average)</i>
All Industries	60
Agriculture	320
Construction	227
Mining and Quarrying	167
Transportation and Public Utilities	160
Government	60
Manufacturing	40
Trade	27
Services	27

^a Adapted from Cohen and Lee, 1991

What Are The Health Risks From Radiation Exposure To The Embryo/Fetus?

During certain stages of development, the embryo/fetus is believed to be more sensitive to radiation damage than adults. Studies of atomic bomb survivors exposed to acute radiation doses exceeding 20 rads (0.2 Gy) during pregnancy show that children born after receiving these doses have a higher risk of mental retardation. Other studies suggest that an association exists between exposure to diagnostic x-rays before birth and carcinogenic effects in childhood and in adult life. Scientists are uncertain about the magnitude of the risk. Some studies show the embryo/fetus to be more sensitive to radiation-induced cancer than adults, but other studies do not. In recognition of the possibility of increased radiation sensitivity, and because dose to the embryo/fetus is involuntary on the part of the embryo/fetus, a more restrictive dose limit has been established for the embryo/fetus of a declared pregnant radiation worker. See Regulatory Guide 8.13, "Instruction Concerning Prenatal Radiation Exposure".

If an occupationally exposed woman declares her pregnancy in writing, she is subject to the more restrictive dose limits for the embryo/fetus during the remainder of the pregnancy. The dose limit of 500 mrem (5 mSv) for the total gestation period applies to the embryo/fetus and is controlled by restricting the exposure to the declared pregnant woman. Restricting the woman's occupational exposure, if she declares her pregnancy, raises questions about individual privacy rights, equal employment opportunities and the possible loss of income. Because of these concerns, the declaration of pregnancy by a female radiation worker is voluntary. Also, the declaration of pregnancy can be withdrawn for any reason, for example, if the woman believes that her benefits from receiving the

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occupational exposure would outweigh the risk to her embryo/fetus from the radiation exposure.

Can A Worker Become Sterile Or Impotent From Normal Occupational Radiation Exposure?

No. Temporary or permanent sterility cannot be caused by radiation at the levels allowed under NRC's occupational limits. There is a threshold below which these effects do not occur. Acute doses on the order of 10 rems (0.1 Sv) to the testes can result in a measurable but temporary reduction in sperm count. Temporary sterility (suppression of ovulation) has been observed in women who have received acute doses of 150 rads (1.5 Gy). The estimated threshold (acute) radiation dose for induction of permanent sterility is about 200 rads (2 Gy) for men and about 350 rads (3.5 Gy) for women (National Research Council, 1990; Scott et al, 1993). These doses are far greater than the NRC's occupational dose limits for workers.

Although acute doses can affect fertility by reducing sperm count or suppressing ovulation, they do not have any direct effect on one's ability to function sexually. No evidence exists to suggest that exposures within the NRC's occupational limits have any effect on the ability to function sexually.

What Are Background Radiation Exposures?

The average person is constantly exposed to ionizing radiation from several sources. Our environment and even the human body contain naturally occurring radioactive materials (e.g., potassium-40) that contribute to the radiation dose that we receive. The largest source of natural background radiation exposure is terrestrial radon, a colorless, odorless, chemically inert gas, which causes about 55 percent of our average, non-occupational exposure. Cosmic radiation originating in space contributes additional exposure. The use of x-rays and radioactive materials in medicine and dentistry adds to our population exposure. As shown below in Table 18, the average person receives an annual radiation dose of about 0.36 rem (3.6 mSv). By age 20, the average person will accumulate over 7 rems (70 mSv) of dose. By age 50, the total dose is up to 18 rems (180 mSv). After 70 years of exposure this dose is up to 25 rems (250 mSv).

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Table 18: Average Annual Effective Dose Equivalent to Individuals in the U.S.^a

<i>Source (mrems)</i>		<i>Effective Dose Equivalent</i>	
Natural			
	Radon	200	
	Other than Radon	100	
	Total		300
Nuclear Fuel Cycle			0.05
Consumer Products ^b			9
Medical			
	Diagnostic X-Rays	39	
	Nuclear Medicine	14	
	Total		53
Total			About 360 mrems/year

^a Adapted from Table 8.1, NCRP 93 (NCRP, 1987).

^b Includes building material, television receivers, luminous watches, smoke detectors, etc. (from Table 5.1, NCRP 93, NCRP, 1987).

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